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The Relationship Between Students' Digital Activity and their Perceptions of the Effectiveness of AR-Based Assessment of Academic Performance on Social Media

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Abstract. Immersive technologies are being actively introduced into people's lives, increasingly involving them in the digital environment. Social networks are no exception, integrating various augmented reality (AR) masks to entertain and encourage users' digital activity. This study aims to determine the relationship between students' digital activity and their perception of AR masks on social media for assessment. The quasi-experimental method combined the analysis, survey and pedagogical experiment. The sampling size included 491 undergraduate students from L.N. Gumilyov Eurasian National University and A. Margulan Pavlodar Pedagogical University. Fourteen purposefully-designed AR masks for the TikTok social network in the discipline of Information and Communication Technologies were used in the formal assessment of the academic achievements of 253 students in the experimental group. The remaining 238 students were in the control group being evaluated traditionally. In addition, a survey was conducted to identify the link between students' digital activity and perceptions of the effectiveness of

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these AR masks. The results revealed that the level of digital activity of students is moderate (M = 3.25, SD = 0.66), while assessment using AR masks is perceived as more effective than traditional ($t(252) = -16.7$, $p < 0.001$). This suggests that even a moderate level of digital activity can substantially enhance the effectiveness of AR-based assessment. The results of the conducted pedagogical experiment show an increase in the average score from 66.4% to 71.2% and confirms the hypothesis about the effectiveness of using AR masks in social networks for the formative assessment of academic achievements. It can be concluded that AR masks on social networks serve as a valuable complement to traditional formative assessment methods, effectively capturing and reflecting students' digital activity.

Keywords: academic achievements; assessment; AR masks; digital activity; social media

1. Introduction

In the context of the digital transformation of education, new approaches to measuring various aspects of learning activities are emerging. One of them is digital activity, which encompasses the most susceptible social group to technological innovation, i.e. students. They find themselves at the epicenter of such changes and expand the understanding of "digital activity", turning it into a complex phenomenon combining the educational, scientific, social and daily activities of students. The relevance of digital student engagement is driven by the growth of innovative technologies in the educational environment and the need for socialization and communication, which impacts the development of soft skills and psychological well-being.

The digital activity of students stimulates the introduction of new assessment methods regarding their academic achievements. This is also strengthened by digital literacy and cognitive flexibility of students. In addition, assessment helps to determine the level of training of students and based on it, to build up the necessary knowledge and skills in a structured manner. Assessment of academic achievements is a process of establishing the degree of conformity of acquired knowledge, skills and predetermined educational goals, the results of which are recorded in a formalized form (score, rank) in accordance with the approved scale (Broadbent et al., 2021; Tridane et al., 2015; Ghiatău et al., 2011). According to current narratives, there are different types of assessment (current, formative, final), each of which performs a specific set of functions (Børte et al., 2023).

In contrast to the traditional approach, where the controlling function dominated, the modern educational paradigm emphasizes the developmental and diagnostic potential of assessment. In this sense, assessment serves more as a tool for feedback, motivation where correction of the educational trajectory comes to the fore, which is fully implemented within the framework of formative assessment (Earl & Katz, 2006). Therefore, considering these shifts, the current study focuses on exploring the potential of using AR masks in social media as an innovative tool for formative assessment. This tool allows to transform the assessment procedure from an ascertaining to an activity-based one, stimulating engagement and

providing data for the development of students' digital activity. There are gaps in research on the use of modern immersive technologies that can influence student engagement and activity in formative assessment. In particular, AR-based assessment delivered through social media could offer greater freedom of dissemination by removing constraints of time and place. In this context, digital activity serves as an indicator of the applicability and effectiveness of AR-assessment implemented via social networks.

Immersive technologies that can expand the perception of three-dimensional space and create the effect of total immersion in a virtual environment represent an innovative and promising direction in the field of education. A significant number of scientific studies are conducted aimed at identifying the impact of virtual and AR technologies on the features of human perception, the assimilation of educational material and the development of spatial thinking (Chang et al., 2022). A network and cluster analysis of 21,667 publications on virtual reality and 9,944 publications on AR from the Web of Science Core Collection database showed that AR is a more modern and effective tool actively used in various fields, has an interdisciplinary character and is more adapted to educational purposes (Cipresso et al., 2018).

Immersive technologies, capable of expanding the perception of three-dimensional space and creating the effect of complete immersion in a virtual environment, represent an innovative and promising direction in the field of education. A significant amount of scientific research is being conducted to identify the impact of virtual and AR technologies on the characteristics of human perception, the assimilation of educational material, and the development of spatial thinking (Chang et al., 2022). Network and cluster analysis of 21,667 publications on virtual reality and 9,944 publications on AR from the Web of Science Core Collection database showed that AR is a more modern and effective tool, actively used in various fields, is interdisciplinary in nature, and is better adapted to educational purposes (Cipresso et al., 2018).

The large-scale integration of augmented reality technologies into the infrastructure of social networks, in particular through the active use of AR masks and filters, creates the prerequisites for an in-depth study of their potential impact on students' academic achievements (Blum, 2024; Fehrmann, 2025). Such a convergence of educational technologies and popular social media functions requires a comprehensive analysis of their impact on student engagement, motivation, and, ultimately, on their academic achievements (Abinaya & Vadivu, 2023; Cao & Yu, 2023). The development of various AR masks and the use of superimposed effects have become mainstream among the majority of users and influencers of the Alpha and Z generations (Cocchia et al., 2024).

However, such technologies are mainly of an entertainment nature, while there is very little research devoted to their integration into social networks for the purpose of assessing students' academic achievements. This study aims to explore how these easily accessible AR tools that activate students, often perceived as simple entertainment, can be repurposed or used in an educational

context to improve the learning process (Abinaya & Vadivu, 2023). This study aims to explore how these readily available AR tools that engage students, often perceived as mere entertainment, can be repurposed or used in an educational context to enhance learning (Obiso & Daisy, 2024; Tutkyshbayeva & Zakirova, 2024).

Empirical data confirm the significance of the chosen direction. As part of a large-scale study involving 200,351 respondents in Australia, AR technology on the Facebook social network was successfully tested to teach children the basics of road safety (Zamani, 2024). The authors of this paper note the need to develop a variety of measurement tools for assessing knowledge and analyzing behavioral patterns in social networks, which correlates with the goals of this study. In another research context, where AR filters were initially used for entertainment and self-expression, their significant pedagogical potential was revealed.

It has been shown that this tool contributes to the socialization and improvement of adolescents' self-esteem, acting as a catalyst for creativity, the development of uniqueness and the regulation of emotions (Ibáñez-Sánchez et al., 2022). The researchers conclude that it is advisable to purposefully develop AR masks for educational purposes. An important factor in their effectiveness is gamification, which contributes to increased user engagement and can be used to meet learning needs (Javornik et al., 2022). Thus, the analysis of scientific literature allows us to state that the digital activity of students can positively affect the effectiveness of assessing academic achievements through AR masks in social networks and represents a promising research area.

To identify the most relevant digital platforms on a global and national scale, a secondary analysis of data from reputable statistical portals was conducted. According to Statcounter, Facebook retains a stable leadership in the global ranking of social networks for the period from January 2024 to January 2025, with a stable share of 62.51% (StatCounter, 2025). A different picture is observed in the Kazakhstan segment. Similarweb analysts, ranking the popularity of applications in the Google Play Store, predict TikTok's leadership in the social networks category by the end of 2024, while Instagram occupies the second position (Similarweb, 2025).

This trend is confirmed by the research of the internationally recognized platforms Statista (Statista, 2025) and AppFigures (Appfigures, 2025), which also identify TikTok as the most popular social network in Kazakhstan. The statistical portal DataReportal provides comprehensive data on the country's digital development in its annual review. According to this report for January 2024, the audience of social networks in Kazakhstan reached 14.10 million users, which is equivalent to 71.5% of the total population. The gender structure of this audience is almost balanced: 48.9% are men and 51.1% are women (DataReportal, 2024).

The most significant factor for this study is the age structure of users. The data show that the absolute majority of the audience (95.9%) is represented by young people and users of young working age: the 18-24-year-old group accounts for

49.8%, and the 25-34-year-old cohort accounts for 46.1%. The total share of users over the age of 35 does not exceed 4% (Start.io, 2025). The revealed age concentration makes social networks a highly potential environment for organizing educational communications with the student audience.

The above trends form a comprehensive prerequisite for conducting scientific research aimed at developing and testing a model for evaluating educational achievements using AR masks in social networks. The relevance of this aspect is due to its correspondence to the key vectors of the evolution of the digital educational environment. The integration of AR masks into the assessment process makes it possible to quickly activate students, providing instant feedback, increasing student autonomy, supporting collaborative learning and enhancing the validity and reliability of assessment results.

The purpose of this study is to determine the relationship between students' digital activity and their perception of the effectiveness of academic assessment using AR masks on social media.
Within the framework of this study, the following research questions were formulated:
1. How can AR masks be developed and implemented on social media for formative assessment of student academic achievement?
2. What is the level of students' digital activity when using AR-assessment via social media?
3. What is the relationship between students' digital activity and their perception of the effectiveness of assessment using AR masks?

The following sections of the article present a step-by-step description of the research methods, the results, the discussion and the conclusions.

2. Methodology

The design of the study was multi-stage and covered various aspects of assessing students' academic achievements. The study employed a quasi-experimental method, involving a comparison of experimental and control groups, that identified the impact of the use of AR masks in social networks on the learning outcomes of students. The data was collected between December 2024 to April 2025 from two Kazakhstani universities: L.N. Gumilyov Eurasian National University in Astana and A. Margulan Pavlodar Pedagogical University in Pavlodar.

The step-by-step nature of the research ensured its consistency and elaboration, allowing a comprehensive look at research issues to achieve the goal. The definition of academic discipline, the development and implementation of AR masks, the conduct of a pedagogical experiment and then a survey contributed to a more accurate identification of the relationship between digital activity and the effectiveness of AR-assessment. This approach ensures the methodological integrity and reliability of the results obtained.

The phased nature of the study ensured its systematicity and thoroughness, allowing for a comprehensive approach to the research questions to achieve the objective. Defining the academic subject, developing and implementing AR masks, conducting a pedagogical experiment, and then conducting a survey facilitated a more precise identification of the relationships between digital activity and the effectiveness of AR-assessment. This approach ensures the methodological integrity and reliability of the results. The preparatory stage of the study focused on the choice of an academic discipline, based on which assessment materials, test tasks, scenarios and AR masks were to be developed. "Information and Communication Technologies", which is a mandatory component of all bachelor's degree programs, was identified as such a discipline. This provided ample opportunities for conducting experimental work.

The choice of the discipline was determined by its targeted learning outcomes, which provide for the active involvement of students in social and linguistic communication using modern educational technologies, including ICT, in their future professional activities. In addition, AR technology is based on the principle of interactive feedback with visualization of objects, which predetermined the choice of a universal and visually rich subject or thematic section. The developed evaluation materials included visual elements, were accompanied by sound effects and had multimedia capabilities that expand the perception of three-dimensional space. The introduction of gamification elements into AR masks has not only made the assessment process more exciting and interactive, but also contributed to the active participation of students, the formation of a competitive atmosphere and stress reduction. Together, these allowed the use of AR masks as an effective tool for formative assessment that goes beyond formal testing.

In the next stage of the study, in accordance with the set pedagogical tasks and methodological requirements for assessment materials, a set of 14 specialized AR masks were developed and published on the TikTok social network. Each mask was conceptually related to specific educational topics and was intended to test relevant knowledge and competencies. The development was carried out in the Effect House environment, the official platform for creating AR effects for TikTok. The choice of this environment was due to its widespread use among the target audience (students), the availability of detailed documentation and powerful tools optimized for mobile devices (Figure 1).

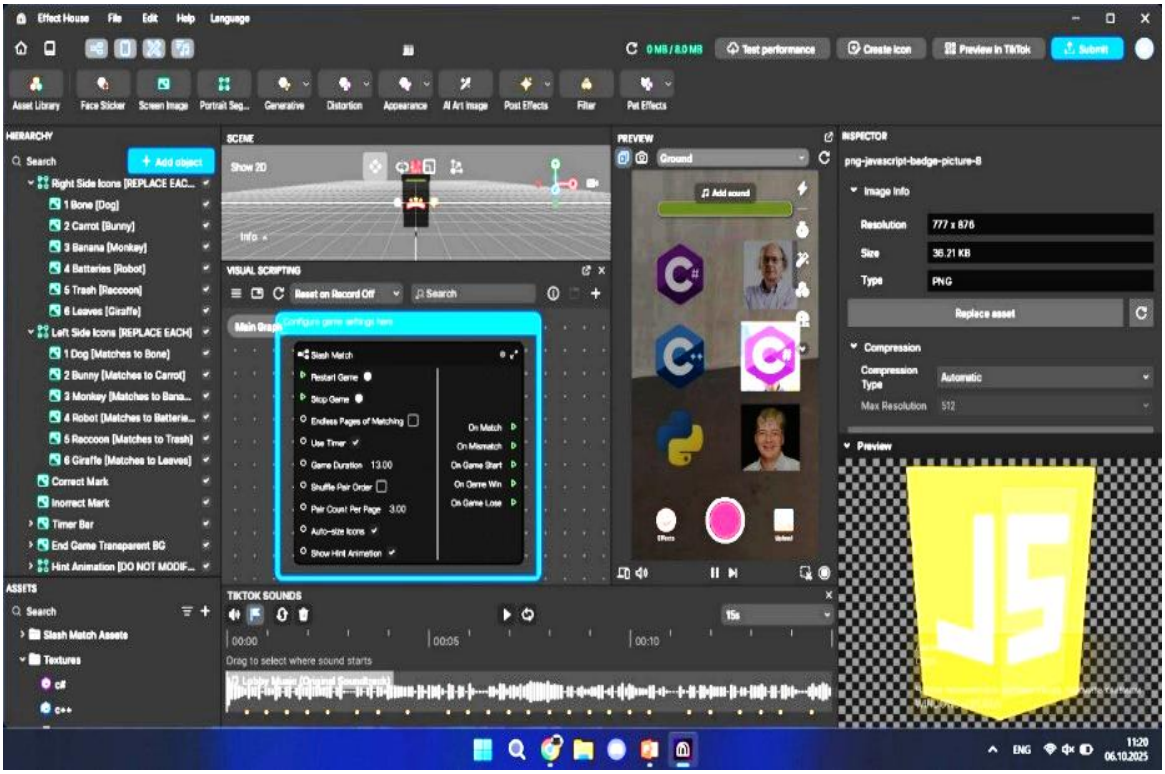


Figure 1: The process of developing AR masks in the Effect House

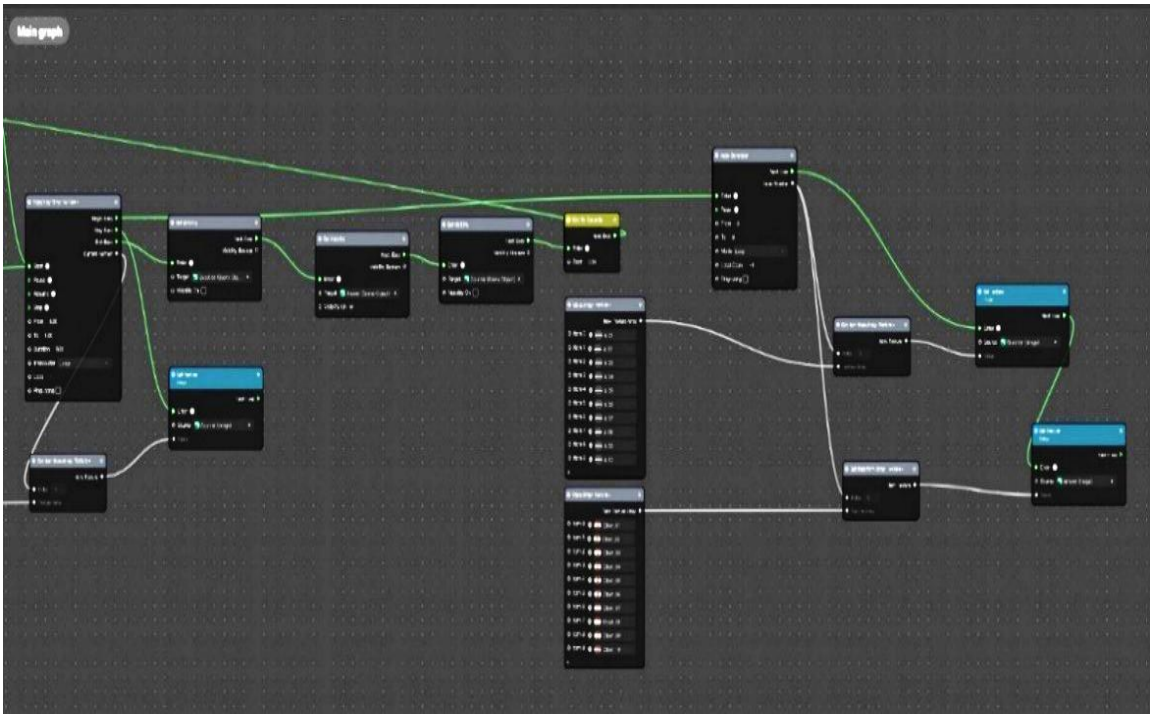
The technical implementation of the developed AR masks was based on the integrated use of the technological stack of the Effect House platform, which can be structured in the following three key areas. The fundamental basis is made up of computer vision and tracking algorithms that operate in real time based on machine learning.

In particular, the stable operation of masks is ensured by the Face Tracking system, which allows for precise positioning and fixing of 3D objects and animations on the user's face with full synchronization during facial expressions and angle changes. Additional realism in the integration of virtual content is provided by segmentation technology, which provides for the selection and separate processing of image elements, such as hair or background. To create interactive pedagogical scenarios, a gesture recognition module (Hand Tracking) was used, where certain kinesthetic user actions are programmatically defined as triggers for activating learning actions or registering responses.

An important aspect of the development was working with the content and physical properties of objects. The platform provides the ability to import 3D models created in professional editors such as Blender or Maya, followed by their animation, which allows creating thematically relevant and visually complex training simulations. To enhance the reliability and interactivity of the interaction, a physics engine and a particle system were used to set the properties of gravity, collisions and inertia to virtual objects, as well as generate visual effects, which significantly increases the level of immersion and persuasiveness of the digital environment.

The logic of the masks' functionality, including algorithms for evaluating academic achievements, was implemented using the visual programming methodology (node-based scripting). This approach, based on the construction of node graphs, where nodes represent functional modules, and the connections between them determine the data flow, allowed us to design complex interactive scenarios without the need to write traditional program code. These include logical chains for checking the sequence of correct answers, timing mechanisms, as well as conditional script branches depending on user actions (Figure 2).

Figure 2: Node-Based Scripting



Additionally, to enhance immersiveness and create a favorable psychological atmosphere during the assessment tasks, the integration of multimedia components, including sound effects and background audio accompaniment - was implemented.

At the main stage of the study, based on the results of the entrance testing in the discipline "Information and communication technologies" (ICT), control and experimental groups were formed. The total number of participants in the experiment was 491 undergraduate students, with 238 students in the control group and 253 in the experimental group. The groups were formed based on similar input test results (pre-test), which made it possible to ensure their comparability. The placement test was a mandatory stage for determining the level of expertise in this discipline for all students, and based on it, participants were selected. A three-level scale was used to assess academic achievements: from 0 to 49% - low academic achievement, from 50 to 74% — average, and from 75 to 100% high.

The experimental group used the developed AR masks as auxiliary assessment tools throughout the entire semester of study in this discipline. At the end of the semester, students underwent a final post-test, the results of which revealed the impact of using AR masks on students' academic achievements.

The results of the experiment were processed using mathematical statistics methods. In this case, the Pearson chi-square formula χ^2 (1) was used to compare the empirical and critical values of the results of the two groups.

$$\chi^2_{Emp} = N \cdot M \cdot \sum_{i=1}^{L} \frac{\left(\frac{n_i}{N} - \frac{m_i}{M}\right)^2}{n_i + m_i} \qquad (1)$$

where:
N – represents the total number of participants in the experimental group;
M – represents the total number of participants in the control group;
n_i – denotes the number of participants in the experimental group who received a score of i;
m_i – denotes the number of participants in the control group who received a score of i (Frost, 2019).

The processing and analysis of the data obtained using mathematical statistics methods made it possible to provide a more accurate and objective assessment of the impact of the developed AR masks on students' academic achievements, identify differences between the experimental and control groups, and establish possible relationships between the studied indicators. After conducting a pedagogical experiment, 253 students of the experimental group participated in a survey that aimed to receive feedback on digital activity using AR masks to evaluate educational achievements. The survey included four substantive blocks:

The first block contained socio-demographic questions, which made it possible to characterize the participants by age, gender, course of study and field of study. The second block was devoted to determining the range of digital platforms used. Respondents indicated the frequency of use of the 10 most popular social networks (Instagram, Facebook, TikTok, Pinterest, VK, Threads, Twitter (X), LinkedIn, Scoop.it и Telegram) on a four-point frequency scale: "never", "rarely", "sometimes", "constantly". The third block of the questionnaire assessed the level of students' digital activity. It included eleven statements rated on a five–point Likert scale (from 1 - "totally disagree" to 5 – "totally agree") (see Appendix 1).

The allegations related to various aspects of the educational use of social media, such as information retrieval, sharing educational materials, interacting with colleagues, preparing classes together and discussing research ideas. Based on the responses, an integral indicator of digital activity was calculated as the average value for all points on the scale. The internal consistency coefficient of the scale was $\alpha = 0.89$, which indicates its high reliability. The fourth block of the questionnaire measured the perception of the effectiveness of assessing students' academic achievements in two formats: traditional and using AR masks. For this purpose, the scale of perception of assessment effectiveness developed by the

authors was used, which included 10 statements evaluated on a five–point Likert scale (from 1 - "completely disagree" to 5 – "completely agree") (see Appendix 1). Participants were asked to compare both types of assessment, reflecting their perception. The survey data was collected using Google Form toward the end of the semester during classes, so that the respondent could reason and objectively respond by comparing according to personal experience. The Jamovi program (Version 2.6) was used to process the survey data.

The analysis included descriptive statistics methods (Mean, SD, Min–Max) to determine general trends and distribution of data, as well as checking the reliability of scales using Cronbach's coefficient. To test the hypotheses, the student's t-test for paired samples was used to compare the average values of the effectiveness of traditional and AR-assessment, and correlation analysis (Pearson's r) was used to identify the relationship between students' digital activity and the perception of the effectiveness of AR-assessment.

All research procedures complied with international standards of ethics. The participants provided informed consent to participate and were informed about the voluntariness, confidentiality and anonymity of data collection. The ethical principles of the research corresponded to the requirements of the Ethical Code of the American Psychological Association (APA, 2020) and the Ethical Principles of the Kazakhstan Educational Research Association (KERA, 2020).

The following sections outline the results, discussion and main conclusions of the study.

3. Results

In general, the results of the conducted research on the use of AR masks as an auxiliary assessment tool in social networks showed the digital activity of students and a positive impact on their academic achievements. The following are the results for each stage of the study.

3.1 Development and implementation of AR masks in social networks

The prepared assessment materials on the discipline "Information and Communication Technologies" covered the following topics: "ICT in everyday life and education", "Core system components. IT architectures", "Software & Operating Systems", "Human–computer interaction basics", "Networks and Telecommunications", "Cloud computing concepts and Mobile Technologies", "Database Systems", "Multimedia systems and classifications", "Smart Technologies" and "E-Services". AR masks were developed on the presented topics (Figure 3) and implemented in social networks, which allowed for a wider dissemination of assessment materials.

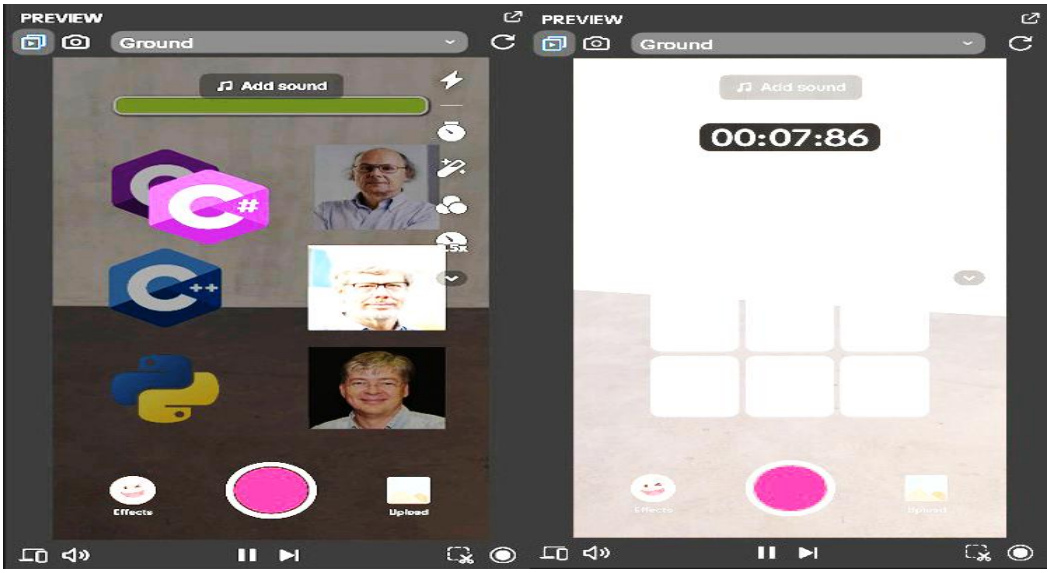
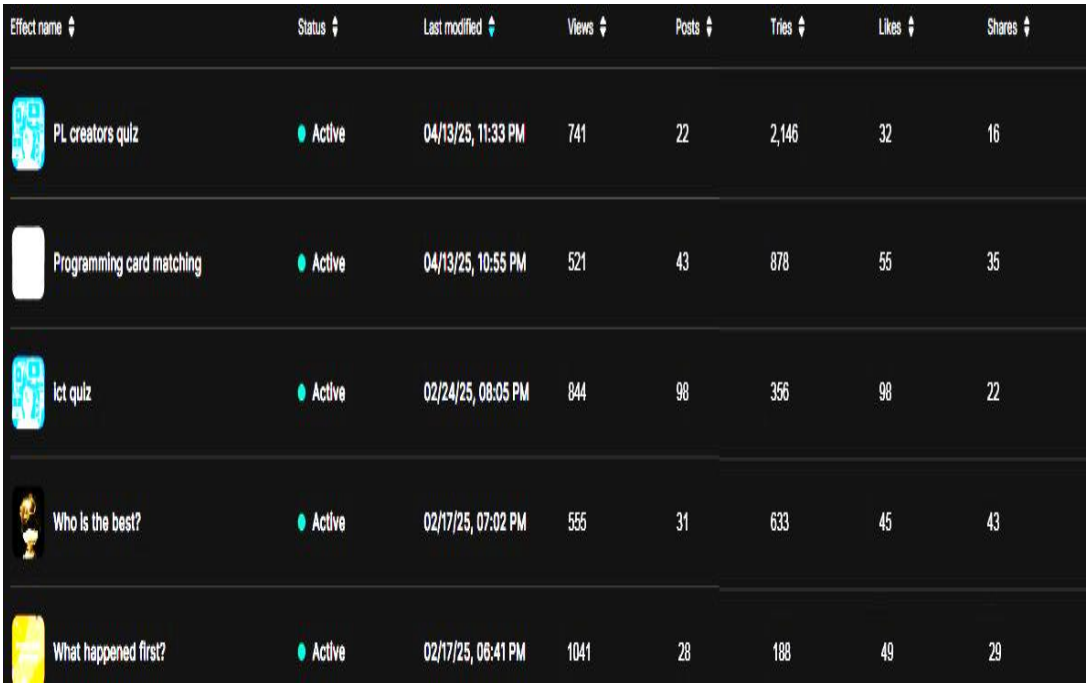


Figure 3: Examples of designed AR masks in the Effect House

The developed AR masks had different forms of tasks (true or false, multiple choice, multiple response, fill in the blank, matching drag-and-drop, sequence, drag-and-drop, hotspot, etc.) and types of interactivity (Touch-based interaction, Voice Interaction, Input Field, Gesture interaction, Face Recognition), which are filled with multimedia materials (audio, video, pictures, gifs, animations, 3D objects). All this has helped to make the content of the AR mask questions on the above topics more attractive. Students used AR masks during classes under the supervision of a teacher, as well as independently at any convenient time through social networks, since the assessment was formative.

Detailed statistics on the distribution of the developed AR masks can be tracked using the Effect House analytics module (Figure 4), which is presented in its interface. The most viewed is the AR mask with the task of arranging it in the correct order, which has 1 041 views. It can be noticed that students actively discover and use AR masks, but do not try to post with them. With the "ICT-quiz" mask, the maximum number of posts was 98. However, attempts to use the developments show that students are actively discovering and applying AR masks. The largest number of attempts was with the mask "PL creators quiz" – 2 146.



Effect name	Status	Last modified	Views	Posts	Tries	Likes	Shares
PL creators quiz	Active	04/13/25, 11:33 PM	741	22	2,146	32	16
Programming card matching	Active	04/13/25, 10:55 PM	521	43	878	55	35
Ict quiz	Active	02/24/25, 08:05 PM	844	98	356	98	22
Who is the best?	Active	02/17/25, 07:02 PM	555	31	633	45	43
What happened first?	Active	02/17/25, 06:41 PM	1041	28	188	49	29

Figure 4: AR Mask Analytics at Effect House

Qualitative findings show students' positive attitudes toward AR-assessment masks on social media throughout the entire semester of study. Detailed comments and observations of the dynamics of interaction showed a steady interest in the tool, increased engagement and a positive user experience.

The qualitative findings complemented the quantitative indicators and confirmed that the perception of AR masks as a convenient and motivating means of formative assessment persisted in the long term. The results of the main stage, i.e. the pedagogical experiment, were based on the passing of pre-test and post-test by the control and experimental groups. The pre-test helped to determine the zero position of the two groups, and the post-test was aimed at identifying the impact of the developed AR masks on social networks as an auxiliary assessment tool on students' academic achievements and their digital activity.

Based on the results of the pre-test, the students of the control and experimental groups were identified. The average pre-test value of the control group was 67.21%, and the experimental group 66.39%. The students' academic achievements were divided into three levels. The results showed that the number of low-level students in the control group was 66, and 71 in the experimental group. The average level was demonstrated by 123 students in the control and 130 in the experimental groups, while high results were achieved by 49 students in the control and 52 in the experimental groups (Figure 5).

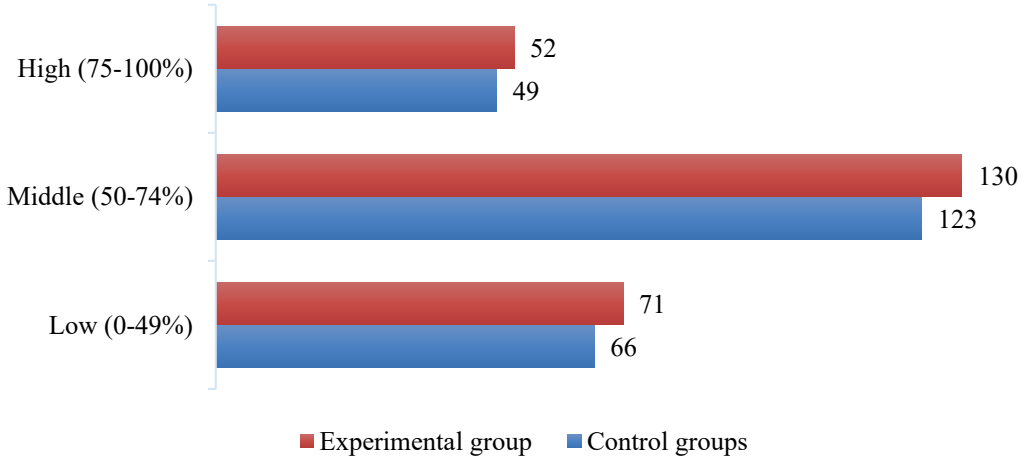


Figure 5: Pre-test results

The post-test showed that 51 students in the control group and 52 in the experimental group had a low-level academic achievement. A middle level was shown by 132 students of the control group and 126 students of the experimental group, and a high level was shown by 55 students of the control group and 75 students of the experimental group (Figure 6).

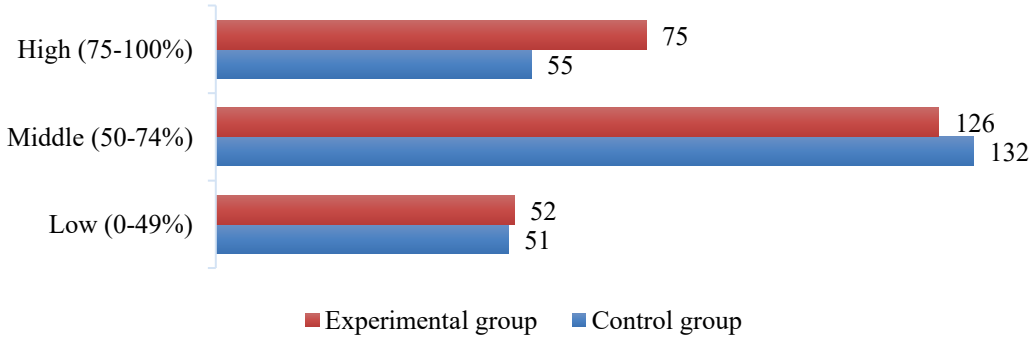


Figure 6: Post-test results

The processing of the results involved comparing the empirical and critical values of Pre-test and post-test using Pearson's chi-square formula χ^2. With a three-level assessment scale, the critical values for the significance level α=0.05 is 5.99 (Frost, 2019).

The calculations of the empirical value are given below:

- based on the results of the pre-test

$$\chi^2_{Emp}=253\cdot238\cdot\left[\frac{\left(\frac{71}{253}-\frac{66}{238}\right)^2}{71+66}+\frac{\left(\frac{130}{253}-\frac{123}{238}\right)^2}{130+123}+\frac{\left(\frac{52}{253}-\frac{49}{238}\right)^2}{52+49}\right]=4{,}815649219$$

- based on the results of the post-test

$$\chi^2_{Emp} = 253 \cdot 238 \cdot \left[\frac{\left(\frac{52}{253} - \frac{51}{238}\right)^2}{52+51} + \frac{\left(\frac{126}{253} - \frac{132}{238}\right)^2}{126+132} + \frac{\left(\frac{75}{253} - \frac{55}{238}\right)^2}{75+55} \right] = 7{,}589444073$$

As can be seen from the calculations, before the start of the pedagogical experiment, the empirical value was less than the critical value, which was $\chi^2_{Emp} = 4{,}815649219 < 5{,}99$ (Table 1). This means that the initial level of the control and experimental groups was almost the same. After the experiment, it became larger, that is, $\chi^2_{Emp} = 7{,}589444073 > 5{,}99$. This means that the conclusion is accepted that the impact of AR masks on social networks as a tool for assessing students' academic achievements has been positive.

Table 1: Empirical values of χ^2_{Emp} control experimental groups

Group	CG (pre-test)	EG (pre-test)	CG (post-test)	EG (post-test)
CG (Pre-test)		**4,815649219**	2,586877828	11,53037224
EG (Pre-test)	0,703216359		7,742054674	7,16281368
CG (Post-test)	1,446890479	3,000989288		**7,589444073**
EG (Post-test)	5,087637558	2,812590299	7,079920068	

The average value of the scores obtained in the control group increased from 67.2% to 69.1%, and in the experimental group from 66.4% to 71.2%. Conducting a pedagogical experiment on the use of AR masks as an auxiliary assessment tool has shown that this approach contributes to the methodological support of students' knowledge level in the discipline being studied and accompanies the educational process throughout the entire period of study. In addition, the students showed great interest in using AR masks, actively creating various Reels and participating in trends, freely expressing themselves on social networks. Taking into account the revealed interest, it became necessary to expand the range of AR masks being developed and integrate them into a wider range of academic disciplines.

3.2 Digital activity of students in assessing academic achievements

The survey results show that Instagram (M = 3.15, SD = 0.90) and Telegram (M = 2.85, SD = 0.98) are the most popular among students, which are mainly used for communication and exchange of educational information (Table 2). TikTok is used somewhat less frequently (M = 2.18, SD = 1.13), which may be due to its entertainment format, but also to the growing interest of students in educational videos.

Other platforms, such as Facebook (M = 1.84) and Pinterest (M = 1.83), are used sporadically, mainly in the context of searching for illustrative and methodological content. Threads, Twitter (X), LinkedIn and Scoop.it (M ≈ 1.2), reflecting the weak integration of professional networks and content platforms into students' daily learning activities.

In general, the data obtained indicates the dominance of mobile messengers and visual platforms focused on the rapid exchange of messages and visual content, which must be taken into account when introducing AR tools and digital forms of assessment into the educational process.

Table 2: Frequency of social media usage by students

	Descriptive statistics				
	Average	Median	SD	Minimum	Maximum
Instagram	3.15	3	0.900	1	4
Facebook	1.84	1	1.051	1	4
TikTok	2.18	2	1.126	1	4
Pinterest	1.83	1	1.029	1	4
Vk	1.58	1	0.830	1	4
Threads	1.24	1	0.583	1	4
Twitter (X)	1.24	1	0.578	1	4
Linkedin	1.25	1	0.604	1	4
Scoop.it	1.23	1	0.550	1	4
Telegram	2.85	3	0.976	1	4

The students' digital activity was assessed using the author's scale of 11 statements reflecting the frequency and nature of the use of social networks for learning purposes. The answers were recorded on a six—point Likert scale, where 1 meant "never" and 6 meant "constantly." The average value on the scale was M = 3.25 (SD = 0.66, Min = 1.98, Max = 4.94, n = 253), which corresponds to a moderate level of digital activity among students (Table 3).

The highest average values were found for items related to the search and consumption of educational information: "I use social networks to search for information related to educational activities" (M = 4.01, SD = 1.47) and "I am interested in new content related to my studies" (M = 3.95, SD = 1.44). This indicates the students expressed interest in learning content and the use of the digital environment as a tool for self-development. The indicators reflecting productive forms of digital interaction were slightly lower, such as "I use educational materials with friends" (M = 2.41) and "I use new educational ideas with friends" (M = 2.48).

Thus, the digital activity of students is characterized by a pronounced search and communication profile with an emphasis on the consumption and exchange of educational content. The data obtained confirm that social networks serve primarily as a channel for educational information and interaction, to a lesser extent as a space for joint creativity and the use of educational initiatives.

Table 3: Indicators of students' digital activity

	Average	Median	SD	Minimum	Maximum
Q1. I use social media to search for information related to learning activities	4.01	4	1.465	1	6
Q2. I am interested in new content related to my studies	3.95	4	1.444	1	6
Q3. I use social media to search for information on specific subjects	3.77	4	1.468	1	6
Q4. I share educational and scientific materials on social media	2.87	3	1.546	1	6
Q5. I use social media to share information related to my academic career	3.43	3	1.579	1	6
Q6. I share important information related to my studies with my friends on social media	3.25	3	1.573	1	6
Q7. I share educational content on social media	2.92	3	1.585	1	6
Q8. I'm preparing for classes with my friends on social media	2.70	2	1.555	1	6
Q9. I use new ideas with my friends on social media	2.48	2	1.441	1	6
Q10. I use educational materials with my friends on social media	2.41	2	1.435	1	6
Q11. I discuss research ideas on social media	2.43	2	1.469	1	6
Digital activity	3.25	3.25	0.656	1.98	4.94

The results of the paired t-test showed statistically significant differences between the traditional and AR-assessment of students' academic achievements ($t(252) = -16.7$, $p < 0.001$). As can be seen from Table 4, the average efficiency perception index was higher when using AR masks ($M = 3.41$, $SD = 0.27$) than in the traditional format ($M = 3.02$, $SD = 0.25$).

The difference of 0.39 points indicates that students perceive AR-assessment as more interesting, understandable and fair. Cohen's effect size $d = 1.05$ indicates a large effect of differences, which confirms the hypothesis of the study about the higher efficiency of AR-assessment compared with the traditional one.

Table 4: Comparison of perception of the effectiveness of traditional and AR-assessment (t-test for paired samples, n = 253)

Assessment format	Medium (M)	SD	t (252)	p	Cohen's d
Traditional	3.02	0.25			
AR-assessment	3.41	0.27	-16.7	<0.001	1.05

As shown in Table 5, a negative but statistically insignificant correlation was found between students' digital activity and perception of the effectiveness of AR-assessment (r = -0.033, p = 0.597). This means that the level of digital activity of students does not significantly affect their attitude to the use of AR technologies in assessment. In other words, both active and less active users of social networks generally perceive the effectiveness of AR tools in the educational process in the same way.

Table 5: Correlation between digital activity and the effectiveness of AR-assessment

Variables	r (Pearson)	p	n
Digital activity ↔ AR-assessment	−0.033	0.597	253

The results of this study provide a deeper understanding of the relationship between students' personal qualities and their digital activity, including preferences in using AR-assessment in social networks. Students' digital activity is reflected in their interest in new assessment tools.

4. Discussion

4.1 Development and implementation of AR masks in social networks

The results of the study show that the successful implementation of AR masks should take into account the real preferences of students in using digital platforms. The dominance of Instagram (M = 3.15) and Telegram (M = 2.85) confirms that visually saturated and communication environments are the most convenient for learning content, which is consistent with the conclusions of Fayda-Kinik (Fayda-Kinik, 2023), which emphasizes the effectiveness of AR technologies in visually oriented digital ecosystems. Low demand for professional networks (LinkedIn, Twitter/X; M ≈ 1.2) indicates the limited use of these platforms for educational purposes. Similar trends were observed by Alhabash and Ma (2017), who showed that young users are much more likely to choose entertainment and visual platforms than professional ones, reflecting the specifics of their digital behavior.

4.2 Digital activity of students in assessing academic achievements

The digital activity of students is at a moderate level (M = 3.25), while digital behavior is mainly of a search and informational nature. The dominance of items related to the search for educational information (M = 4.01 and M = 3.95) indicates that students perceive social networks primarily as a resource for obtaining educational content. This corresponds to the findings of Al-Rahmi (Al-Rahmi et al., 2022), according to which social networks enhance access to academic

information and support students' self-learning. The low rates of productive forms of digital interaction (M = 2.41–2.48) confirm that students are less likely to use social media to collaborate, discuss ideas or co-create educational materials. Similar conclusions are presented in a study by Manca & Ranieri (Manca & Ranieri, 2016), which emphasizes that students in higher education primarily use social platforms in a passive mode – to consume information, rather than to create it together. According to the authors, even with high involvement in social networks, educational and collaborative functions are much less in demand, which is consistent with the results obtained in our study.

In the context of this digital activity profile, the results of comparing traditional and AR assessments are particularly significant. The paired t-test showed a pronounced advantage of the AR format (M = 3.41) compared to the traditional assessment (M = 3.02), $t(252) = -16.7$, $p < 0.001$, with a large Cohen's effect size of $d = 1.05$. This means that even with moderate digital activity, students show a significantly more positive attitude toward AR-assessment, perceiving it as more understandable, fair and motivating. These results are consistent with studies on the impact of AR on the learning process, which show increased engagement and perception of transparency in assessment (Ibáñez & Delgado-Kloos, 2018).

4.3 The relationship between the level of digital activity of students and their perception of the effectiveness of assessment through AR masks

The absence of a statistically significant correlation between the level of students' digital activity and their perception of the effectiveness of AR-assessment ($r = -0.033$, $p = 0.597$) indicates that social media usage habits are not a key factor in the adoption of innovative assessment technologies.

A similar conclusion is observed in the study by Bond et al. (2020), where it was found that a high frequency of digital activity does not guarantee a positive attitude toward new educational technologies – pedagogical expediency and the subjective value of technology play an important role. In addition, research shows that the perception of innovative tools is more often related to the perception of their usefulness and convenience, rather than to the general level of digital activity (Teo, 2019). This is consistent with our data where students who actively use social media do not demonstrate a greater willingness to perceive AR-assessment as more effective.

On the contrary, the response to AR technology turns out to be fairly uniform regardless of the intensity of digital behavior, which is consistent with the findings of Darvishi et al. (2020), showing that the perception and adoption of AR tools is determined not by the frequency of use of digital platforms, but by factors such as the feeling of learning pleasure, the clarity of the interface, and the pedagogical value of technology. The authors emphasize that even students with high digital activity do not necessarily demonstrate a more positive attitude toward AR if the technology does not provide clear educational benefits or causes cognitive stress.

These results support our interpretation meaning that digital activity alone is not a predictor of the perceived effectiveness of AR-assessment. Thus, it can be assumed that the integration of AR-assessment requires not only the digital activity of students, but also specially organized pedagogical design, training and supportive conditions that form an informed perception of the benefits of AR technologies.

5. Conclusion

Nowadays, assessment approaches should not only be technological, but also relevant to the student's daily life. The implementation of innovative forms of assessment into the world of social media may increase the level of digital activity of students, helping to fill existing gaps in research on formative assessment. AR masks on social networks have served as an excellent example of an auxiliary assessment tool that has a wide audience of distribution, accessibility and involves the effect of introducing virtual objects into our three-dimensional space. However, such integration requires more scientific and methodological attention.

Therefore, the purpose of this study was to determine the relationship between students' digital activity and their perception of evaluating academic achievements using AR masks on social networks. The quasi-experimental method provided an integrated approach to the study of various aspects of the problem while strictly considering research ethics. The experiment that lasted six months at two universities in Kazakhstan showed a positive trend in the use of AR masks in formative assessment, increasing the average score of the experimental group by 5%. Its positive influence was confirmed by comparing the critical and empirical values of Pearson's chi-square.

The level of digital activity of students remains moderate and is characterized mainly by the search and communicative use of social networks, but AR masks were perceived as a more interesting and fair assessment format. In general, the results confirm the prospects of integrating AR into the assessment system, especially in an environment where digital communication is already a familiar element of the educational process. In the future, it is planned to develop new AR masks for social networks in other disciplines.

6. Conflict of Interest

There is no conflict of interest.

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Appendix 1

Indicators of students' digital activity:
Q1. I use social media to search for information related to learning activities
Q2. I am interested in new content related to my studies
Q3. I use social media to search for information on specific subjects
Q4. I share educational and scientific materials on social media
Q5. I use social media to share information related to my academic career
Q6. I share important information related to my studies with my friends on social media
Q7. I share educational content on social media
Q8. I'm preparing for classes with my friends on social media
Q9. I use new ideas with my friends on social media
Q10. I use educational materials with my friends on social media
Q11. I discuss research ideas on social media
The scale of perception of the effectiveness of the assessment:
Q1. Traditional assessment makes the knowledge testing process interesting.
Q2. Traditional assessment helps me to better understand the assessment criteria.
Q3. Feedback in the traditional format motivates me to improve results
Q4. The traditional assessment process seems fair and transparent to me
Q5. I believe that traditional assessment makes the knowledge verification process effective.
Q6. AR masks make the assessment process more interesting
Q7. Using AR masks helps me to better understand the evaluation criteria
Q8. Feedback through AR masks motivates me to improve results
Q9. The use of AR masks increases the fairness and transparency of the assessment
Q10. I believe that using AR technology makes the assessment process more efficient.