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Digital educational environment and the formation of motivation to learn a foreign language among young students

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Abstract. The relevance of the study is due to the growing role of the digital educational environment in the formation of motivation to study a foreign language among young students, for whom technological tools served as the main channel of educational interaction. The purpose of the study was to identify and model psychological and pedagogical conditions that ensure stable educational motivation of students aged 17-21 in a digital environment. The study applied a theoretical analysis of modern approaches to the study of motivation, systemic modelling of components of educational activity, structural and functional analysis of digital technologies. Based on the results obtained, a practical programme for the formation of motivation to study a foreign language in a digital environment was developed. The results of the study showed that students' motivation was determined by the interaction of three key components: awareness of the educational goal, emotional safety of the educational environment and sociocultural relevance of the educational material. The programme demonstrated an increase in students' cognitive activity, increased interest in completing educational tasks, improved attitude towards the use of digital tools, and increased readiness to apply knowledge in practical situations. Participants noted greater involvement in the educational process, a sense of support, and the ability to independently regulate the pace of learning, which contributed to the formation of intrinsic motivation. The practical value of the work lies in creating an integrated model of motivation for learning a foreign language in a digital environment and developing a programme that can be used in higher education institutions to improve the quality of foreign language teaching. The research materials can be used by teachers, methodologists, and developers of digital educational courses

Keywords: gamification; student learning activity; adaptive learning platforms; intrinsic motivation; psychological needs; educational technologies; multimedia learning tools

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INTRODUCTION

In the modern educational space, the formation of motivation to learn a foreign language appears as a complex interdisciplinary problem, which is especially relevant in the context of the digitalisation of the educational process. The youth period (17-21 years), which falls on the period of obtaining higher education, is a sensitive period for the development of autonomy, professional identity and social integration. It is during this period that students' internal motivation is formed on the basis of cognitive maturity,

emotional self-regulation and social interaction. In modern conditions, students are often influenced by external digital stimuli, which can both activate interest in learning and reduce concentration and motivation due to information overload. At the same time, the integration of multimedia technologies – such as gamification, simulations, virtual reality and adaptive platforms – opens up new opportunities for personalising learning and supporting the motivational sphere of students.



In scientific discourse, motivation for learning is considered a key component of successful educational activity. Researcher J. Santrock (2020) showed that it is during adolescence that a cognitive breakthrough occurs, which allows students to comprehend goals, plan the educational trajectory, and critically evaluate the progress, emphasising the growth of reflexivity and the ability for metacognition as key factors in the formation of learning motivation. Researchers R. Ryan & E. Deci (2020) within the framework of the self-determination theory substantiated that motivation acts as a function of satisfying basic needs for autonomy, competence, and social interaction. Scientists developed a conceptual model that explained the mechanisms of the transition from extrinsic to intrinsic motivation through the process of internalising values and learning goals. Researcher F. Guay (2021) applied the self-determination theory to the educational context, showing that types of behavioural regulation, psychological needs, and autonomous-supportive behaviour of teachers directly influenced students' academic achievement.

Researchers Y. Wang *et al.* (2024) conducted a meta-analysis of the effectiveness of interventions based on self-determination theory and found that student- and teacher-centred approaches significantly improved intrinsic motivation and met students' basic psychological needs. Y. Wang (2024) found that interactive online learning environments can reduce anxiety, improve emotional well-being, and develop critical thinking skills in college students. Researchers J. Wong & B. Hughes (2023) concluded that the use of learning experience design principles in digital media could influence motivational characteristics that supported students' learning behaviour in undergraduate online courses.

Regarding the impact of gamification on motivation to learn a foreign language, researchers Z. Shen *et al.* (2024) found that gamification significantly and positively affected language learning achievement, with student motivation acting as a mediator in this relationship. Z. Luo (2023) conducted a systematic review of the effectiveness of gamified tools for foreign language learning and found mixed results and noted that most studies measured affective and behavioural engagement, while cognitive engagement remained understudied. S. Chan & N. Lo (2024) found that gamified educational frameworks clearly increased student engagement and motivation in the process of learning English, stimulated interest, and reduced anxiety. Researchers X. Wang *et al.* (2024) used structural equation modelling to find that the level of competence in the field of artificial intelligence and augmented and virtual reality technologies was a significant predictor of engagement and motivation.

In Ukrainian scientific works, L. Bondar & N. Lytvynchuk (2020) established the role of emotional and cognitive processes in the formation of the motivational sphere. R. Kyrychenko & A. Kolodiazna (2021) revealed the relationship between self-esteem, autonomy, and sustainability of motivation of future teachers. However, most existing studies focused either on general aspects of motivation or

on the influence of individual digital tools, without integrating cognitive, behavioural and humanistic approaches in relation to this age group. Also, insufficient attention was paid to the cultural and educational features of the Ukrainian context, which is critically important in the current conditions of reforming the higher education system. The aim of the study was to provide a theoretical justification for and methodological analysis of the factors of motivation formation for learning a foreign language in students aged 17-21 in a digital educational environment, taking into account the cognitive, emotional and sociocultural features of this age period.

MATERIALS AND METHODS

The present study was theoretical and aimed at a comprehensive analysis of the factors that form motivation to learn a foreign language in students aged 17-21 in a digital educational environment. The methodological basis of the study was the integration of three key approaches to the analysis of motivation in education: cognitive, behavioural, and humanistic. Such integration allowed for a comprehensive interpretation of motivational processes in students: as a result of meaningful cognitive strategies and expectations (Vroom, 1964; Santrock, 2020), as a reaction to external stimuli and reinforcement (Skinner, 1953), as well as a manifestation of internal psychological needs. The combination of these approaches allowed for the creation of a multidimensional theoretical framework that can encompass various aspects of motivational processes in a digital educational environment. In this context, a special place was occupied by the self-determination theory (SDT) proposed by R. Ryan & E. Deci (2020), which considered motivation as a function of satisfying basic needs for autonomy, competence, and social interaction. This theory was chosen as the central methodological basis of the study, since it most fully reflected the specifics of youth period, when the need for autonomy and self-determination is particularly acute. SDT allowed explaining the mechanisms of the transition from extrinsic to intrinsic motivation, which was critically important for the formation of a sustainable interest in learning a foreign language.

As part of the study, a conceptual analysis of five interconnected theoretical models was carried out, which together formed the methodological basis for studying the impact of digital educational technologies on motivation to learn a foreign language. The Attention, Relevance, Confidence, Satisfaction (ARCS) model, developed by J. Keller (2010), was chosen to analyse the motivational design of the digital learning environment. This model allowed structuring four key components of motivation: attracting students' attention, ensuring the relevance of educational material to the life goals, building confidence in the students' abilities and creating a sense of satisfaction from achievements. The Substitution, Augmentation, Modification, Redefinition (SAMR) model, analysed by M. Kharbach (2025), was used to classify the levels of integration of digital technologies into the educational process – from a simple replacement

of traditional tools to a complete rethinking of educational activities. This model made it possible to assess how deeply digital technologies transformed students' motivational processes. The Technological Pedagogical Content Knowledge (TPACK) model, proposed by P. Mishra & M. Koehler (2006), was used to analyse the integration of technological, pedagogical and subject knowledge of teachers. This model served as an architectural framework that ensured pedagogically sound design of the educational process and was most closely associated with the cognitive component of motivation through the structure of educational content and the effective selection of digital tools. The Computer-Assisted Language Learning (CALL) approach, first described by J. Higgins (1983) and updated by H. Reinders & S. Chong (2023), was used to analyse the specifics of the use of computer technologies in foreign language learning, which ensured the practical implementation of language experience in a digital environment. SDT served as a unifying framework for interpreting the results of the analysis of all previous models through the prism of satisfying the basic psychological needs of students. The choice of these five models was justified by the complementarity: ARCS modelled motivational dynamics, SAMR determined the degree of digital transformation, TPACK provided a pedagogical basis, CALL focused on the specifics of language learning, and SDT provided a psychological justification for all processes. Together, these models made it possible to explain how the digital environment activated motivational mechanisms through relevance, involvement, gamification, adaptation of educational content, and support for students' psychological comfort.

The main research method was a systematic analysis of scientific literature, which included the search, selection and critical analysis of modern works on pedagogical and age psychology, educational theory and empirical studies of the impact of digital technologies on the educational activity of young people. The source base comprised publications from international scientometric databases (Scopus, Web of Science, PubMed) for the period 2020-2025, which ensured the relevance and significance of the analysed material. The criteria for selecting sources were: the presence of empirical data on the impact of digital technologies on student motivation, focus on the age group of 17-21 years or students of higher education institutions, application of the theory of self-determination or other relevant motivational theories and publication in peer-reviewed scientific publications. To illustrate theoretical provisions and visualise the relationships between the components of motivation, digital educational platforms Quizlet, Duolingo, and Kahoot! were used, which were selected as representative examples of the practical implementation of the models under study. The analysis of the functionality of these platforms was carried out through the prism of the ARCS, SAMR and CALL models to determine the mechanisms of influence on various components of motivation. Structural-functional analysis was used to systematise the components of motivation (cognitive, emotional and sociocultural) and determine the

functions of each component in the formation of sustainable learning motivation.

Comparative analysis was used to compare the effectiveness of different methodological approaches (cognitive, behavioural and humanistic) in the formation of motivation of young students. The theoretical modelling method allowed creating an integrated model of the formation of motivation for learning a foreign language in a digital environment, which combined all five theoretical approaches studied. The modelling procedure involved the sequential derivation of the structural components of the model from the provisions of each theory: three basic psychological needs (autonomy, competence, social interaction) were taken from SDT, which determined the target orientations of the entire model; four motivational components (attention, relevance, confidence, satisfaction) were derived from the ARCS model, which formed the structure of each training module; the SAMR model identified the levels of digital transformation of training tasks – from replacing traditional exercises to rethinking language practice through immersive technologies; TPACK provided the pedagogical basis for the integration of technological, methodological and linguistic content, defining the principles of selecting digital tools; CALL specified the specifics of computer-mediated language learning through interactive exercises, automated feedback and adaptive algorithms. Based on this synthesis, the Language XP programme modules were formed: an autonomous learning module (realisation of the need for autonomy through SDT + personalisation according to ARCS), a competency development module (gradual complication of tasks according to SAMR + confidence formation according to ARCS), a social interaction module (collaborative tasks based on CALL + satisfaction according to ARCS) and a gamified practice module (transformational level of SAMR + relevance according to ARCS), all modules were designed taking into account the principles of TPACK to ensure the pedagogical feasibility of technological solutions. Tables and figures were used to visualise the results of the theoretical analysis. The result of the development was a methodological justification for the procedure for assessing the effectiveness of the model. It involves the implementation of the Language XP programme in the educational process, with subsequent diagnostics using validated tools. The proposed structure allows for comprehensive monitoring of the dynamics of internal motivation, the level of psychological comfort and the quality of students' academic results in a digital environment.

RESULTS AND DISCUSSION

Analysing the theoretical basis of the motivational sphere in students aged 17-21, it is worth focusing on the basic definitions, cognitive characteristics and social changes that affect the educational activity. The formation of motivation to learn a foreign language in students aged 17-21 is based on a combination of psychological, age and sociocultural factors. According to the scientific literature, motivation is considered as a central regulator of

behaviour that determines the direction, intensity, and duration of educational activity (Ryan & Deci, 2020; Kyrychenko & Kolodiazna, 2021). In this context, it is relevant to clarify key concepts: motivation is an internal or external stimulus that activates and organises the behaviour of an individual to achieve certain goals. It acts as an integrator of needs, interests, and values; motivation for learning – a type of learning activity, driven by interest in the subject, the significance of knowledge, or social expectations (Bondar & Lytvynchuk 2020); motivational sphere of personality – a system of stable motives that determine educational behaviour and the ability to overcome difficulties on the

way to achieving goals (Mata & Hertwig, 2011; Symonds *et al.*, 2019). As already noted, adolescence (17-21 years) is a critical stage of psychological development, when the ability to be independent, professional self-determination, and conscious learning is formed. During this period, cognitive processes intensify, reflexivity increases, and social identity is strengthened, which directly affects the structure and dynamics of motivation for educational activity. Taking into account these changes, it is possible to distinguish three main domains of age development that have the greatest impact on motivation for learning a foreign language, which is reflected in Table 1.

Table 1. Three key domains of age development that influence motivation

No.	Development domains	Characteristics of the age group 17-21 years	Impact on motivation to learn a foreign language
1	Cognitive	The ability to plan, metacognition, and abstraction increases	Strengthens self-regulation and strategic thinking in learning
2	Emotional	Emotional stability is formed, anxiety is reduced	Provides endurance in learning, reduces fear of mistakes
3	Social / sociocultural	Professional identity and group interaction are developing	Stimulates extrinsic motivation through feedback and recognition

Source: compiled by the author based on E.H. Erikson (1968), J.J. Arnett (2000), R. Mata & R. Hertwig (2011), J.W. Santrock (2020), R. Ryan & E. Deci (2020)

The age interval 17-21 years, according to the concept of “emerging adulthood” by J.J. Arnett (2000), is a period of active self-determination, when a young person seeks a balance between individual autonomy and social belonging. The theory of psychosocial stages of development by E.H. Erikson (1968) defines this period as a transition from identity to closeness, where motivation to learn is associated with an understanding of one’s place in society. According to J.W. Santrock (2020), during this period a cognitive breakthrough occurs, which allows one to comprehend goals, plan an educational trajectory and critically evaluate one’s own progress. These factors form a favourable soil for the development of intrinsic motivation, especially in a digital environment that meets individual needs and learning styles. Given the specifics of students’ cognitive, emotional, and social development in adolescence, it is appropriate to consider how these aspects are manifested in the structure of the motivation to learn a foreign language. Motivation at this stage of life is formed as a multidimensional system, based on the interaction of three key components – cognitive, emotional, and sociocultural. Each of these components plays a unique role in supporting or inhibiting learning activity, especially in the digital educational environment.

The cognitive aspect of motivation is associated with the student’s mental activity: setting goals, planning learning activities, reflecting on results, and the ability for metacognition – conscious control over one’s own thinking (Santrock, 2020). Students who have well-developed

cognitive strategies plan learning tasks more effectively, independently organise the time, and demonstrate greater resilience to difficulties. In the context of digital learning, this is manifested in the use of adaptive platforms, time management in online courses, and the formation of individual educational trajectories. For example, interactive programmes such as Quizlet or Duolingo, which require regular planning and monitoring of progress, activate the cognitive sphere of motivation. It is associated with the student’s ability to predict the outcome, independently adjust learning behaviour, and achieve autonomy in language acquisition (Ryan & Deci, 2020). The emotional sphere determines how the student experiences the learning process, what emotions are associated with learning, and how these emotions affect the sustainability of motivation. The period from 17 to 21 years of age is characterised by increased sensitivity to evaluation, the need for self-affirmation, and the importance of support from the environment (Erikson, 1968; Arnett, 2000). High self-esteem and a sense of success increase intrinsic motivation, while anxiety, fear of making mistakes, or comparing oneself to others can block it. The emotional component is especially activated in digital learning environments, when students work independently.

Platforms such as Kahoot! or Edmodo, which provide positive emotional feedback, increase motivation through the achievement effect. Support from the teacher and the group is also a key factor in creating a safe emotional environment where motivation is not suppressed by feelings of

insecurity (Ryan & Deci, 2020). The sociocultural component of motivation is formed on the basis of identity, cultural belonging, and social expectations. At the age of 17-21, students are actively searching for the place in society, and learning a foreign language is perceived as a tool for social advancement, integration, and mobility (Arnett, 2000). The formation of a positive perception of one's own education and competence in intercultural communication stimulates internal and external motivation. The digital environment opens up wide opportunities for cultural interaction: participation in international projects, online communities, and exchange of experience with native speakers. For

example, platforms such as iTalki or Tandem, create conditions for intercultural dialogue, which enhances sociocultural motivation through the experience of authentic communication and inclusion in the global language environment. Given the complex nature of motivation for learning in young students and its multi-component structure, special attention is paid to the choice of adequate methodological approaches to its formation in the digital educational environment. Each of the approaches – cognitive, behavioural, and humanistic – offers its own understanding of the mechanisms of motivation, focusing on its various determinants (Table 2).

Table 2. Comparative table of methodological approaches to the formation of motivation

Approach	Key ideas	Strengths	Limitation	Elements for integration
Cognitive	Motivation as a result of expectations, goals, metacognition	Supports autonomy, develops thinking, self-regulation	May decrease in the face of failure or low self-esteem	Planning, reflection, strategic learning
Behavioural	Motivation is formed through reinforcement	Fast activation, efficiency at the initial stage	Does not form a sustainable interest, depends on external stimuli	Gamification, rewards, feedback
Humanistic	Motivation as a desire for self-realisation	Promotes internal motivation, autonomy, and psychological comfort	Requires an individual approach, difficult to implement in mass education	Autonomy support, meaning, personal significance

Source: compiled by the author based on B. F. Skinner (1953), V. Vroom (1964), R. Ryan & E. Deci (2020), J.W. Santrock (2020), J.J. Arnett (2000)

The analysis of the characteristics presented in Table 2 demonstrates that each of the three approaches – cognitive, behavioural and humanistic – highlights only certain aspects of motivational processes in the digital educational environment, which justifies the use of an integrative methodology in this study. This is especially true for young students, who are characterised by the need for structure, emotional support and autonomy at the same time. In this regard, an integrative approach that combines strategic thinking, external stimulation and the development of intrinsic motivation seems appropriate. Such an approach creates conditions for the formation of a flexible motivational system that is able to adapt to the dynamics of the educational process and the individual needs of students.

After analysing the components of motivation, it becomes appropriate to consider how modern educational technologies can serve as catalysts for motivational processes in students aged 17-21. In this context, attention is focused on three key areas: multimedia technologies, theoretical models of digital media integration in learning, and applied solutions in the field of foreign language learning. The analysis of theoretical models and digital solutions in the field of foreign language learning allows asserting that educational technologies are not only a tool for knowledge transfer, but also a powerful stimulator of cognitive, emotional, and social motivation of young students. Due to the combination of interactivity, personalisation, and

gamification, multimedia solutions are a powerful factor in forming and maintaining motivation for learning. One of the key mechanisms is gamification – the inclusion of game elements, such as points, badges, and ratings, which stimulate motivation through the mechanism of competition and expectation of rewards. This is especially effective for young students who are inclined to seek achievements and social recognition. Another example is virtual reality environments that provide the effect of immersion in a language context. Such environments increase emotional engagement, create a sense of presence in real communicative situations, and help reduce the fear of making mistakes – a factor that significantly affects students with high levels of anxiety or low self-esteem. Another tool is adaptive learning platforms that can adapt to the individual pace of the student, analyse typical errors and take into account the student's interests. This stimulates cognitive activity, enhances self-reflection and promotes the development of metacognitive strategies. Therefore, the use of multimedia technologies allows simultaneously activating the cognitive, emotional and sociocultural components of motivation, creating a more holistic and effective educational environment. The integration of the ARCS, SAMR, CALL and TPCK models into the educational process allows creating a complex motivational system, where each model performs a unique function within the cognitive, emotional and sociocultural components (Fig. 1).

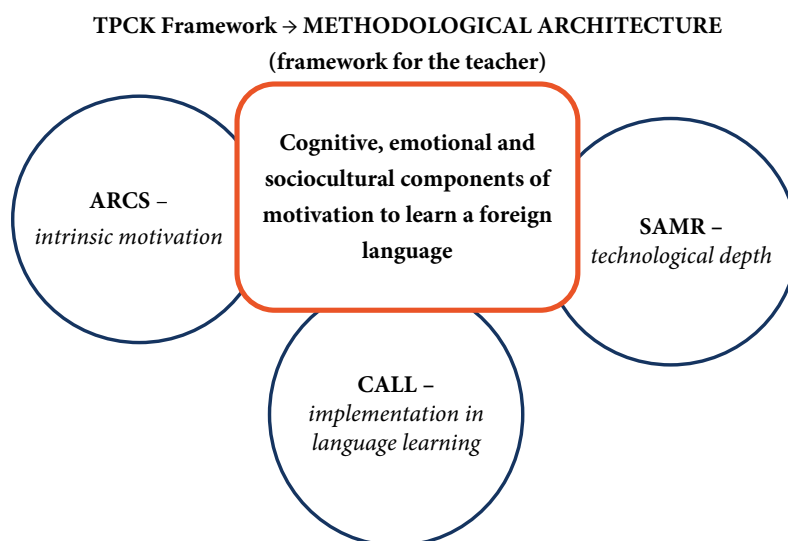


Figure 1. An integration model for the application of ARCS, SAMR, CALL, and TPCK models in the formation of motivation for learning a foreign language in a digital educational environment

Source: developed by the author based on B.F. Skinner (1953), V. Vroom (1964), E.R. Ryan & E. Deci (2020), J.W. Santrock (2020), J.J. Arnett (2000)

As can be seen in Figure 1, the TPCK (Technological-Pedagogical-Content Knowledge) model serves as an architectural framework that ensures the consistent application of other models – ARCS, SAMR, and CALL – in the motivational environment of digital learning. The results of the study showed that although TPCK does not directly affect motivation, it creates the conditions for its implementation through pedagogically sound design of the educational process. This model is most closely related to the cognitive component of motivation: it contributes to the structuring of educational content, the effective selection of digital tools and the activation of students' metacognitive strategies. In this context, the ARCS model structures motivational dynamics through a focus on attention, significance, confidence and satisfaction, SAMR determines

the degree of digital transformation of learning, and CALL provides practical implementation of language experience in a digital environment. Thus, the integration of these approaches allows influencing all three key components of motivation – cognitive, emotional and sociocultural – and forms a holistic psychological and pedagogical strategy adapted to the characteristics of young students. In order to systematise the impact of the developed programme on the key components of motivation of students aged 17-21, a summary table of the modules of the developed Language XP programme is presented below. Each module combines specific tools and methods aimed at activating the cognitive, emotional, and sociocultural potential of the student, which allows for the holistic implementation of an integrated model of motivational support (Table 3).

Table 3. Language XP programme modules and the impact of these modules on students' motivational components

Language XP module	Basic tools	Motivation component	Theoretical models
Activation module	Motivational interview, video introduction, setting individual goals	Cognitive, emotional	ARCS, TPCK
Gamified workshop	Gamified exercises, points, badges, and ratings system	Emotional, cognitive	ARCS, SAMR
VR communication module	VR scenarios, interactive role-playing communication	Sociocultural, emotional	SAMR, CALL
Reflective module	Digital diary, self-assessment, coaching	Cognitive	ARCS, TPCK
Language hub / CALL module	Authentic materials, immersive tests, audio, and video chats	Sociocultural, cognitive	CALL, TPCK

Source: developed by the author

As can be seen from Table 3, each programme module performs a target function within one or several motivational vectors. The gamified workshop supports the emotional component through a system of points, skill levels (from "Novice" to "Expert"), virtual badges and weekly

competitions. This system activates the dopaminergic mechanisms of the brain and satisfies the need for competence, demonstrating to students the progress. The reflective module promotes cognitive self-regulation through digital learning diaries with metacognitive questions about

the effectiveness of strategies and areas for improvement. Automatic visualisation of progress through graphs enhances the sense of autonomy and control over learning. The virtual reality module simultaneously activates all three components: cognitively creates an authentic context for language practice, emotionally reduces the fear of error through interaction with virtual characters, socioculturally models real communicative situations in a cultural context. Adaptive trajectories analyse patterns of learning behaviour (speed of execution, types of errors, preferences for formats, productive time of day) and automatically adjust the complexity and format of tasks. Such personalisation supports a sense of competence, ensuring work in the zone of optimal development. The social interaction module creates virtual language communities based on interests, organises online meetings with native speakers, and selects language partners, satisfying the need for social connectedness. The integration of the ARCS, SAMR, TPCK, and CALL models in each module provides a balanced impact: ARCS supports attention, relevance, confidence, and satisfaction; SAMR determines the level of technological transformation; TPCK guarantees pedagogical validity; CALL provides the principles of communicative competence and authenticity. The Language XP programme represents a comprehensive motivational system with a synergistic effect of supporting all components of student motivation. The results of the theoretical study are consistent with modern empirical data on the key role of the digital educational environment in shaping students' motivation to learn a foreign language. The proposed integrated model was confirmed in studies of the period 2020-2025.

In particular, the results obtained in the study are consistent with the scientific findings of Q. Zheng *et al.* (2025), who proved that digital literacy of EFL students is a significant predictor of the effectiveness in online learning. At the same time, the authors emphasised the mediating role of perceived teacher support, which indicates the decisive importance of pedagogical support even in a technologically saturated environment. This position correlates with current findings on the need to combine digital tools with the facilitatory role of the teacher within the TPCK model. Similarly, the results of M. Vansteenkiste *et al.* (2018) and A. Rezai *et al.* (2025) confirm the importance of informal digital learning of English (IDLE) as a factor in shaping students' motivational sphere. The authors found significant relationships between IDLE, online motivation, learning satisfaction, and telecollaborative anxiety levels, demonstrating that extracurricular digital activity can not only enhance positive emotional experiences but also reduce barriers to cross-cultural communication. This expands the understanding of the sociocultural component of motivation embedded in the current integrated model.

Regarding the central role of self-determination theory in the proposed model, a meta-analysis by Y. Wang *et al.* (2024), which analysed 344 samples (223,209 participants), found that satisfaction of basic psychological needs is a key predictor of academic motivation. These results

justify the feasibility of building the Language XP model around the three basic needs of SDT and support the expansion of the theoretical propositions by demonstrating the possibilities of structuring digital technologies according to the ARCS, SAMR, TPCK, and CALL models. Researchers J. Howard *et al.* (2024) conducted a meta-analysis of 637 samples ($N = 388,912$) and found that autonomy support had the largest effect among the three basic needs. These data reinforce the Language XP model's emphasis on autonomy as a key need for adolescent students, and justify the priority of the autonomous learning module in the programme structure.

Regarding the role of gamification, a study by Z. Shen *et al.* (2024) found a significant positive effect of gamification on language learning achievement, with motivation as a mediator, confirming the feasibility of including a gamified module in Language XP. Importantly, the authors found a moderating role of digital literacy – gamified approaches were more effective for students with higher technological competence. These results indicate the need to diagnose the level of digital literacy of students before implementing the programme and possibly adapt the complexity of gamified elements. Researcher Z. Luo (2023) found mixed results regarding gamification and insufficient study of cognitive engagement in existing tools. The identified gaps justify the structured approach of the Language XP model, where gamification elements are clearly linked to motivational components (attention, relevance, confidence, enjoyment according to ARCS) and psychological needs (autonomy, competence, social interaction according to SDT), which can provide simultaneous support for cognitive, affective and behavioural engagement. Researcher R. Rajapakse (2024) found that excessive information load in the digital environment could reduce students' concentration and motivation due to cognitive overload. Researcher M. Chen (2024) demonstrated that emotional intelligence had a significant impact on the academic achievement of college students, which highlighted the importance of the emotional component in digital learning.

Regarding technological literacy, X. Wang *et al.* (2024) found that AI and AR/VR literacy significantly predicted EFL student engagement and motivation. These results complement the Language XP model by supporting the rationale for introducing technologies at varying levels of difficulty, from basic interactive exercises to immersive VR simulations, according to SAMR levels. Q. Zheng *et al.* (2025) found that perceived teacher support mediated the relationship between digital literacy and the power of online learning, highlighting the importance of the human factor. These findings reinforce the model's premise of the teacher as a facilitator (as per TPCK) and suggest the need for specific teacher training for effective implementation of Language XP. The findings of D. Pérez-Jorge *et al.* (2025) demonstrate the positive impact of VR and AR on motivation, especially for students with language anxiety, which justifies the inclusion of immersive technologies in the gamified practice module and expands the

understanding of the therapeutic potential. Researchers A. Rezai *et al.* (2025) found that informal digital English learning was positively correlated with online motivation in a sample of 532 students. These results complement the Language XP model by substantiating the importance of the sociocultural component and the possibility of integrating students' informal digital practices (social networks, video content, games) into a structured curriculum. Q. Huang (2025) found that technologies significantly reduced language anxiety through the creation of supportive environments, which strengthens the proposition about the emotional component of motivation and justifies the design of a safe digital space in Language XP.

At the same time, some results from other studies indicate potential limitations and areas for improvement of the model. G. Liu *et al.* (2024) found that extrinsic motivation did not predict student satisfaction, highlighting the criticality of intrinsic motivation. These data indicate the need for special attention to the balance of intrinsic and extrinsic motivators when implementing the Language XP programme, and the possible strengthening of elements that support the internalisation of learning goals. K. Dai & Y. Wang (2024) found a complex interaction between satisfaction, anxiety, and boredom in a technological environment. These results complement the Language XP model with an understanding of the need for flexible adaptation to individual differences in students and the possible implementation of emotional state monitoring mechanisms for timely correction of the learning process.

Summarising the results of the comparative analysis, it can be stated that the proposed Language XP model is consistent with the main trends of modern research published between 2020 and 2025. In particular, the central role of basic psychological needs according to the theory of self-determination, the positive impact of gamification on academic achievement and motivation, the critical importance of students' technological literacy for the effective use of digital tools, the potential of virtual and augmented reality technologies in reducing language anxiety, as well as the need for pedagogical support for teachers in the digital environment are confirmed. At the same time, the Language XP model differs from existing research in its specific focus on the age group of 17-21 years, which allows taking into account the peculiarities of the youth period, in particular the increased need for autonomy and professional self-determination. A key feature of the model is the systematic integration of cognitive, emotional and sociocultural components of motivation through five complementary theoretical models – ARCS for motivational design, SAMR for levels of digital transformation, TPACK for pedagogical framework, CALL for the specifics of language learning and SDT for the psychological justification of all processes.

CONCLUSIONS

The results of the theoretical analysis confirmed that the motivation to learn a foreign language in young students

was formed as a multicomponent phenomenon, based on the interaction of cognitive, emotional and sociocultural factors. The greatest influence on the sustainability of motivation was the possibility of conscious planning of learning and self-regulation, positive emotional experiences associated with success and support, as well as intercultural interaction that activated the linguistic identity of students. The proposed integrated model of the digital educational environment, which combined the principles of SDT with the ARCS, SAMR, TPACK and CALL models, provided a theoretical basis for the systematic support of motivation through targeted influence on its key components. The cognitive component was supported through metacognitive strategies and reflective practices, the emotional component through gamification and the creation of a psychologically safe environment, and the sociocultural component through authentic intercultural interaction and immersion in the linguistic environment. Theoretical modelling showed that digital technologies (adaptive platforms, VR simulations, social networks) could be structured in accordance with the basic psychological needs of students (autonomy, competence, social connectedness), creating conditions for the formation of intrinsic motivation.

The complementarity of the selected theoretical models allowed taking into account the specifics of adolescence: the need for autonomy while maintaining structured support, the importance of social recognition, and the connection of learning with professional self-determination. The systematisation of motivational components and the development of corresponding modules of the digital environment demonstrated the possibility of creating a balanced system of motivational support, where each element performed a specific function, and the combination created a synergistic effect. An integrated approach to the motivational design of the digital learning environment potentially allowed increasing the level of student engagement, making learning more personalised, emotionally meaningful, and culturally relevant. Prospects for further research include empirical testing of the proposed theoretical model, quantitative measurement of the effectiveness of individual components in different academic environments, studying the influence of motivational factors on long-term retention of interest in language learning, and expanding the model for students with different learning styles and levels of language training.

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Цифрове освітнє середовище та формування мотивації до вивчення іноземної мови в студентів юнацького віку

Анотація. Актуальність дослідження зумовлена зростанням ролі цифрового освітнього середовища у формуванні мотивації до вивчення іноземної мови серед студентів юнацького віку, для яких технологічні інструменти виступали провідним каналом навчальної взаємодії. Метою дослідження було визначення та моделювання психолого-педагогічних умов, що забезпечують стійку навчальну мотивацію студентів 17-21 років у цифровому середовищі. У роботі було застосовано теоретичний аналіз сучасних підходів до вивчення мотивації, системне моделювання компонентів навчальної діяльності, структурно-функціональний аналіз цифрових технологій. На основі отриманих результатів було розроблено практичну програму формування мотивації до вивчення іноземної мови в цифровому середовищі. Результати дослідження показали, що мотивація студентів визначалася взаємодією трьох ключових компонентів: усвідомленням навчальної мети, емоційною безпекою освітнього середовища та соціокультурною релевантністю навчального матеріалу. Програма засвідчила зростання пізнавальної активності студентів, підвищення інтересу до виконання навчальних завдань, покращення ставлення до використання цифрових інструментів і зростання готовності застосовувати знання у практичних ситуаціях. Учасники відзначили більшу залученість у навчальний процес, відчуття підтримки та можливість самостійно регулювати темп навчання, що сприяло формуванню внутрішньої мотивації. Практична цінність роботи полягає у створенні інтегрованої моделі мотивації до вивчення іноземної мови в цифровому середовищі та розробленні програми, яку можна використовувати у закладах вищої освіти для підвищення якості навчання іноземної мови. Матеріали дослідження можуть бути застосовані викладачами, методистами та розробниками цифрових освітніх курсів

Ключові слова: гейміфікація; навчальна активність студентів; адаптивні навчальні платформи; внутрішня мотивація; психологічні потреби; освітні технології; мультимедійні інструменти навчання