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Sustainable Learning Process: Assessing the Effectiveness of Teaching Methodology by Analyzing Spatial and Temporal Properties of a Student as a Subject

Natalya Chernova [1,*], Jamila Mustafina [1,*], Manoj Jayabalan [2] and Dhiya Al-Jumeily [2]

[1] Department of Foreign Languages, Naberezhnye Chelny Institute, Kazan Federal University, 423812 Naberezhnye Chelny, Russia
[2] Faculty of Engineering and Technology, Liverpool John Moores University, Liverpool L3 5AF, UK; m.jayabalan@ljmu.ac.uk (M.J.); d.aljumeily@ljmu.ac.uk (D.A.-J.)
* Correspondence: natalchern@gmail.com (N.C.); dnmustafina@kpfu.ru (J.M.)

Abstract: The article outlines the personality of a student as the single channel through which knowledge flows within the cognitive theory of "learning". This sustainable process is the means of mediating the thought activity of an individual in a higher school. The study estimates personal qualities of a student through the capacity for self-organization, self-regulation, self-development, and realization of the self in the process of cognitive development. The aim is to show how the degree of these capabilities' influences achieving the fourth goal, "Quality Education", from the Sustainable Development Goals adopted by the United Nations is determined. Participants were second year students (n = 120) of Naberezhnochelninsky Institute, the branch of Kazan Federal University. They were assigned to Experimental Groups following the "participation" pattern and Control Groups following the standard teaching methodology. The methodological structure presented is an important step towards putting "smart education" into practice. Attempts are made to show that subjective attitude on the part of the students is an indispensable condition for contribution to self-development as a multidimensional system having a complex structure. With respect to it, a multi-level system of estimation, considered in development with stability and variability (statics and dynamics) being joined dialectically (progress line and regression line), is designed. The obtained data provide evidence of the necessity for changing the basis of educational processes towards formation of subject's capabilities while studying academic disciplines. This methodology provides for developing a selective approach to every student.

Keywords: cognitive development; socio-cultural theory; personal qualities; subject's capabilities; "participation" pattern; smart education

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1. Introduction

In accordance with Vygotsky's view of cognitive development, participation in social activity is the act of cognition, which proceeds as follows: the word evokes in the consciousness the image associated with the word; the image reflects the object of reflection in the outside reality. The theoretical core of the socio-cultural theory is the thinking process of interpreting [1]. The authors must attempt to verify the main premise of it in practice, which implies that human beings' psychic processes arise simultaneously with new forms of behavior in which people change material objects, using them as a tool to regulate their interactions with the world and among themselves. This, the so-called mental higher-order activity is mediated by a sign system constructed with words (natural language), and is its defining characteristic. As such, educational activity remains quasi-social in nature. A person remains a function of social interactions, even in a private sphere [2,3].

A highly interactive classroom provides students with the actual experience necessary for sustainable development into a socially active personality. A thorough study of the issue

lets us conclude that aspects such as positive interrelationship between personal qualities and quality of knowledge when using IT in class and the methodology of providing this process is lacking. Taking this into account, the purpose of the study can be formulated as follows.

Under the circumstances, the authors have made an attempt to realize, in practice, the following items:

- Integration of professional and general cultural training of specialists alongside the development of their personal qualities;
- Commitment to self-realization and creative self-expression;
- Human development as a subject of activity [4–6].

The conducted survey should confirm these assumptions. The idea was to assess their relevance within the educational paradigm based on "smart education" and "e-learning" [7]. Over the past 15 years, new technologies have been increasingly applied. Technology-enhanced learning (TEL) can be seen as a tool to disseminate flexibility in the learning process. This research aims at estimating the personal qualities of students that make them able to meet today's challenges in the mode of learning. This problem cannot be solved easily, as teaching methodology is lacking.

A wide variety of activities is a preliminary condition of free self-development, but it works only with a subject of educational activity. All these aspects shift the concept of training from so-called teaching to the concept of participation in various aspects of activity, discourse, reality, and community; this participation cannot be reduced to a simple division between individual and social. Motives, interests, and needs are formed with a functional factor. Finally, the interrelation of a student's activity (functional factor) and his/her interest in it (personality factor) ensure that education is presented not only as ready knowledge but also as a way of thinking. That, in its turn, is the basis for building their own scientific world view [8–10]. The research hypothesis considers this to only be possible when personal qualities are put in the following hierarchy: self-government as the premise of the sustainable development, reflection as a mediating tool, independence, active attitude, and social orientation on the part of a student on the condition of "participation".

2. Problem Background

Training is a form of internalized social activity, and conversational practice is the attribute of the 'participation' concept. Taking it as the dominant teaching technique denies a traditional division between cognition and affect, thus putting forward social factors. The mechanisms of interiorization and exteriorization are held in the affective, emotional, and personal realm [11–14]. This one is expressed through empathy and generation of new life meanings and ideas, which are embodied in independent, free, and responsible actions. Professional training, education, and development of students should be based on these processes. Pedagogy has been in a race between visibility, concepts, and logic. This study makes use of socio-cultural theory to find the solution to the problem. The quantitative evaluation of the above-mentioned personal qualities in class as well as the knowledge achieved presents the data to prove the idea. The methodological tool, which the authors investigate, is an "Instructional conversation". It can be defined as statements, replies, and answers that illustrate the process of learning. The problem under study is also relevant to the concept of "smart education", having been introduced recently [15]. From our point of view, it correlates to a student as a subject of a learning process by means of mobility, interactivity, personalization, and collaboration.

The analysis of the current situation in education shows that pedagogical methods like "actual living", with the perspective of self-development on the part of a student, is not always created in the system of higher education. However, the experience of a student's "being" as an event in all its supposed uniqueness is compensated by "tightening" discipline in the university on the basis of strengthening administrative control. Therefore, the subject of educational activity has an image of the "World" formed on the basis of intellectual and cognitive actions transformed into object-and-practical ones [10].

The author's idea is to let a student, as a subject of educational and professional activities, manifest subjectivity in relation to the object, namely, professionally significant qualities of the person. At the heart of this technique is the thesis of Vygotsky regarding the social origin of the higher mental activity of any individual when estimated in the "zone of proximal development". This concept attracted the close attention of Western scientists (J. Wertsch, J. Bruner, D. Wood, G. Ross) [16]. Vygotsky elected actual and potential levels of development, which reflected the scientist' views on the intrapsychological and interpsychological plans of mental activity, formed by the general genetic law of culture development.

The third cross-cutting theme of the socio-cultural approach sounds like this: the higher mental activity and a man's activity as a whole are mediated by "technical tools" and signs ("psychological tools") [17].

The background to the experimental study is a systematic formation of mental actions and development of fundamentally new attitude to knowledge acquisition. The authors tried to apply two provisions: (1) materialized means create the opportunity to carry out an objective action producing knowledge; verbal means provide awareness, socialization, and interiorization of an action; after a series of changes in the set scale of parameters and organization of proper conditions, the formation of mental action is achieved; (2) the established sequence of action transformation on its forms contributes to the most effective ways of its interiorization along two lines: from the external to the inner, from the collective to the individual. The article studies the role of cooperation between a teacher and a student as well as between students during their study activities.

3. Methodology

3.1. Participants

The experiment was carried out in the second semester of 2022–2023 school year in foreign language classes (English), as the students were already able to participate in unprepared dialogues by this time. Classroom observations were held in the Experimental groups (n = 60) and the Control groups (n = 60) simultaneously, meaning the relevant sample size was large enough to make the data interesting. It adhered to the following sampling criteria: homogeneity (all of them are second-year students), heterogeneity (the same academic discipline). The sample size was alike in both groups and equaled 100%. The selected classes were second-year students of Naberezhnochelninsky Institute (Kazan Federal University).

3.2. Data Collection

The abductive approach was applied. It comprised developing the theory for the problem decision, designing the experiment to test the theory, and data collection in order to provide analysis. All research variables were assessed twice, first by the management of a pretest (the first week of the second semester) and the second by a posttest (the last week). Quantitative and qualitative analyses of potential impacts were developed with the data.

The methodology in this research can be divided into three steps.

3.3. Psychodiagnostics Techniques

The methodological framework of this research is considered in comparison with other views on the process of social interaction in the framework of knowledge acquisition such as spontaneous communication in the classroom by D. Wood, J.S. Bruner, J. Ross, and R. Donato [18–21].

The package of psychodiagnostics techniques to study subjectivity comprises: (1) Diagnosing relationships between collaborators in education (T. Leary's Test); (2) Estimating verbal reactions of the person being tested in alleged situations involving work, study, and external participation (V. Smekal and M. Kucher methods); (3) N.M. Peisakhov's Methodology designed to study students' abilities for self-management. The fundamental method of research is testing.

The study of personal characteristics was the starting point for the research. The idea was that assessments and personal points are important for anyone, and that they lead to personification. As a result of an active position, personality arises on the part of a student [12,22–24].

Background for Estimating Personal Qualities

Semiotic mediation serves as the origin of studying, progress, and human activity in accordance with Vygotsky's socio-cultural theory [25]. Salmon deals with similar problems in her book E-tivities and proposes ways of teaching and E-learning with online courses [26]. It is interesting that a social constructivist approach to online teaching corresponds to Vygotsky's theory in a new stage of pedagogy development. As such, Instructional Conversations or "learning dialogues" can be defined as a means of transmitting information and thinking [27].

It is necessary on the part of a teacher to create a conversational episode in the process of learning. This is only possible if you provide coherence, ensuring that every student has an opportunity to present the archived knowledge and check correct understanding. In addition, new information on the subject should be presented all the time during the lesson to support spontaneity [28,29].

The theory of planned formation of mental actions (Galperin) reveals the system-forming factors of the educational activity formation. The key concept of the theory is "action". In psychology, action refers to activity aimed at achieving a goal, an arbitrary act, an operation, a process subordinated to the concept of result, a vision of the future, i.e., a process subordinated to the perceived (conscious) goal [30]. In the initial stage, the materialized solution carries out an action fulfilled by an object to gain knowledge. In the next stage, private speech helps to realize if students take part in the action in a meaningful way and helps socialization and internalization from external to internal and from collective to individual in accordance with the defined parameter scale. Thus, a mental action is formed. The teaching proceeds relatively quickly, without errors, with the understanding of significant (insignificant) features of the object and action conditions with them and ensures the transfer of knowledge and actions to all specific cases in this field.

The system is successful when acting with an object is organized to implement interiorization through categorizing the allocated objects, structures, actions, and knowledge [31–33].

3.4. Students' Knowledge Assessment

This study also investigated the level of knowledge in Experimental and Control groups. The school curriculum was an obligatory source of data. The basal Higher School Standard Federal Program on the discipline was a learning tool that provides students and teachers with the aims to be achieved [34–37]. The tests on the studied topics and observations of "learning dialogues" in class helped compile the database contents to study and compare. The teachers in both groups complied with uniform requirements regarding the subject content of the training material and teaching hours. Both teachers and students should take part in an instructional conversation as the subject of the learning process. As a result, active participation on the part of the student is the means of mediating personal characteristics and their actualization in a social environment. As such, subjectivity can be used to define the impact of every factorial attribute (personal qualities of a subject) on an effective attribute (academic achievement) [38–42].

3.5. Scheme of Calculation

The received data were to be estimated on the part of the authors. Multiple linear regression models were chosen as a type of regression model that deals with one dependent variable and several independent variables [43–45]. Regression analysis is a statistical method or technique used to determine relationships between variables with a causal relationship. It could also show how close and precise the relationship might be. Regressions were useful for quantifying the relationship or relationships between one variable and

other variables responsible for it. The results were later used to predict the components involved. Most empirical studies in sociology, statistics, and psychology include regression. Its application includes the determination of percentage with personal qualities and identification of factors that can influence the quality of knowledge and help to choose the best methodology in class. Interpreting multiple linear regressions helps to make predictions and guides key decisions [46–49]. The main purpose of interpreting multiple linear regression is to anticipate a response variable. These projections can be extremely useful for planning, monitoring, or analyzing a learning process.

4. Results of Study and Discussion

4.1. Personal Qualities Study

4.1.1. Activity and Independence

Activity and independence were determined to diagnose relationships between collaborators in education. The T. Leary's Test questionnaire was used for both self-assessment of one's qualities and for assessment of behavior observed "from the side", for example, group-mates and a teacher. In addition, it is possible to use the technique for self-evaluation analysis: comparison of real and perfect "I". During the survey, which took the form of questionnaire completion, the individuals showed their own views of the personality. The following results let us draw some conclusions.

The personal quality of independence within the frames of the learning process was identified with 44.86% of the Control groups students and activity with 44.08% as well before the experiment. The experimental groups' students' rates were identified as follows: independence—40.92%; activity—37.95%. The variation of the indicators in all groups did not exceed 7%. Quantitative variation was appropriate to start the experimental study. The post-experiment control measurements showed that the level of independence was 72.5% in the Experimental groups (the increase of 27.64%). The personal quality of activity was 65.4% in these groups, showing an increase of 27.5%. The data below let us prove the soundness of the assumptions made. The data in Control groups were as follows: independence—46.9% (the increase of 2.3%); activity—46.13% (the increase of 2.13%). There was no notable increase in comparison with the first survey. The data are illustrated in Figure 1.

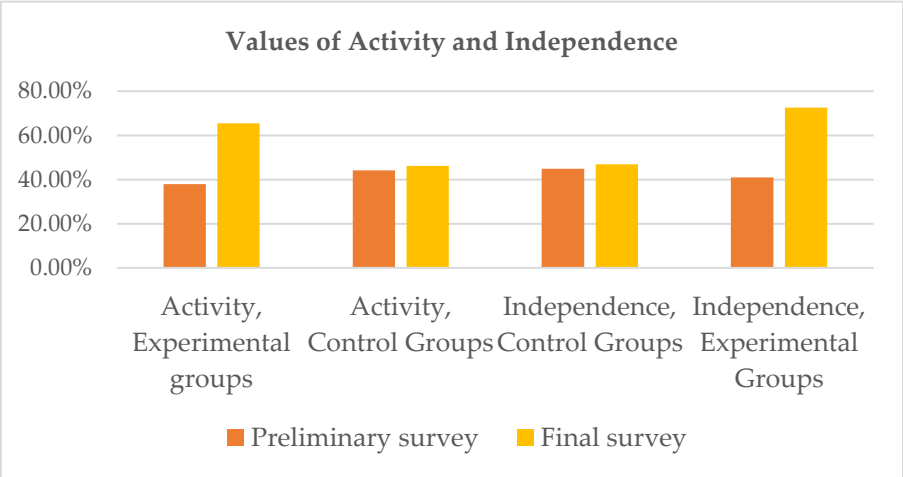

Figure 1. Personal qualities of Activity and Independence in Experimental and Control groups before and after the experimental study.

The data received were processed with "F-test" and "Student's t-distribution". Its integral indicators and empirical values of *t* obtained are shown in Table 1.

Table 1. Integral indicators and empirical values of t.

Personal Qualities	Group	Servey	Integral ϕ (F-test)	Survey	Integral ϕ (F-test)	t Empirical
Activity	Experimental groups	Preliminary	2.499	Final	2.085	12.85
Activity	Control Groups	Preliminary	5.442	Final	10.678	0.53
Independence	Control Groups	Preliminary	14.972	Final	11.224	0.39
Independence	Experimental groups	Preliminary	1.805	Final	3.409	13.38

The reliability is proved because t empirical when estimating activity in experimental group equals to 12.85 > t crit. 4.14; p £ 0.01. These values are significant. In experimental groups t empirical with independence can be considered significant because 13.38 > t crit 4.14, p £ 0.01. So, the Experimental group students demonstrate "human sensual activity" and "subject-subject" relations (L.S. Vygotsky).

The T. Leary's Test questionnaire has never been used by other researchers for estimating activity and independence on the part of the students [5,7,10,44]. The chosen test reflected the interpersonal interaction in social environment. One of the most necessary actions in class is active communication on the part of a student. The research was based on the premise that it could help the student with the development of the subjective position. The main advantage is the abstraction of the questions and veiling. That makes the results more valid but demands much time.

4.1.2. Orientation of Personality

The psychological test by V. Smekal and M. Kucher let us estimate the social orientation of the students under study. This test is a tool to determine which of the targets prevails. Orientation of personality is based on permanent interests, tastes, views, and aims, which, in turn, provide social orientation (Figure 2).

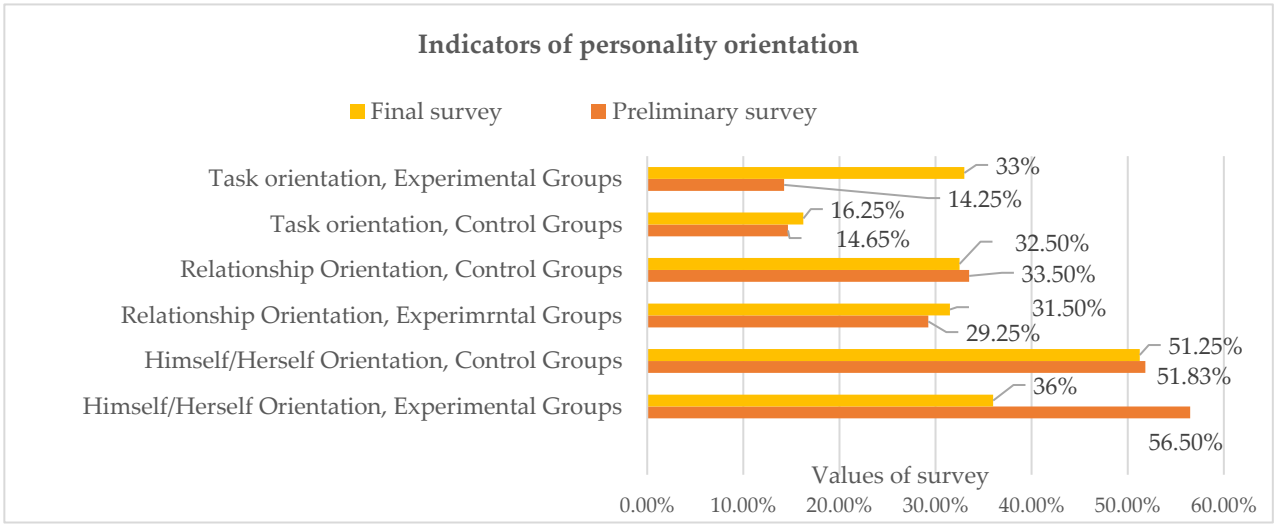

Figure 2. Integral values of social orientation.

The data received were grounds for continuing the experiment. It turned out that indicators' variation was up to 10%. It met the original condition of alike social groups and was the reason to proceed with the formative phase of the scientific study. The students in both groups manifested as being focused on themselves, which testified to lack of independent activity. Thus, the majority of students in both groups could not act as a subject or dominant within the educational activity. Further analysis is given in Figure 3.

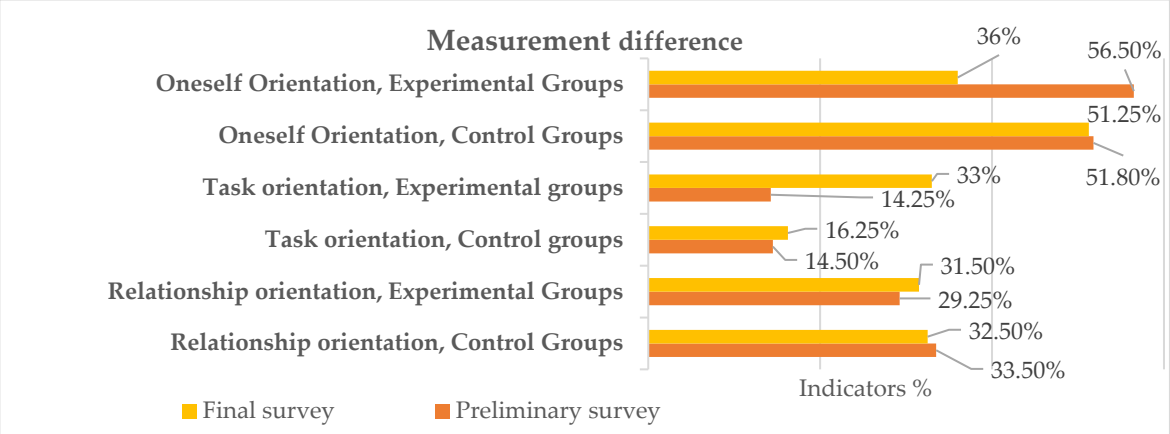

Figure 3. Measurement difference of social orientation data.

The measurement differences showed an increase of 18.75% with "Task orientation" in the Experimental Groups, while "Oneself orientation" went down by 20.5%. The following conclusions can be drawn from these data. We can interpret the personality orientation of students through their capacity for ownership of such processes as organization, regulation, development, and the position of a subject in the educational activity. The authors tried to show the most important moment in Vygotsky's theory explaining the dynamic interdependence of social and individual processes. The authors presented the way to estimate if the teachers had managed and organized the cognitive activity of students and if they had shown the knowledge of student psychology in order to achieve maximum results in learning, creating the necessary psychological climate of trust and communication as a tool in the formation of the subject-and-subject relations in class. This problem is widely studied [5,6,8,10,13,15,20], but other researchers have not tested the process in progress. Especially important is the dynamic interdependence of social and individual processes. In this case, self-transformation is not only the merit, but the value a subject acquires.

Measurement differences did not exceed 1.75% in the Control groups. The lack of the "instructional conversation", according to the methodology under discussion, deprived the students of the ability to see the goal, to find the solution to the problem. As such, there was no opportunity to gain "Task orientation" on the part of these students.

4.1.3. Self-Government Ability

This test (N.M. Peisakhov Kazan Federal University) allowed us to track the essentials of self-government appearance. The researchers could follow the step-by-step formation of eight successively unfolding stages. They ran as follows: "analysis of contradictions, forecasting, goal setting, formation of quality assessment criteria, decision-making for an action, control, correction" [27]. As a result, a subjective position appeared in the way of conscious actions (Figure 4).

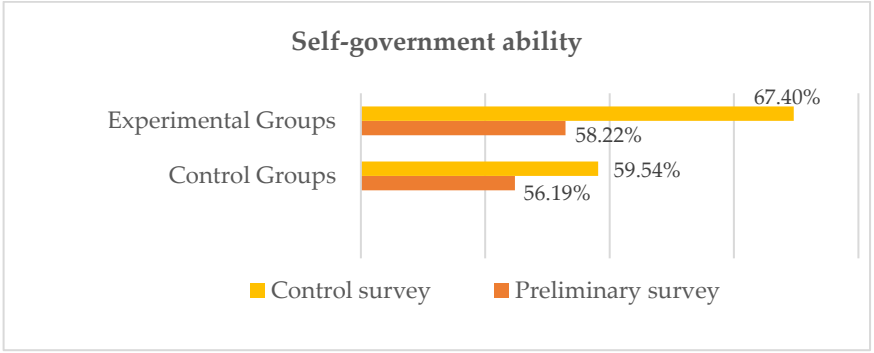

Figure 4. Measurement differences in self-government.

Positive developments in both groups can be observed as evidence of changes in comparison with the pilot study. In the Experimental groups, percentages went up to 67.4% (above average). In the Control groups, the measurement difference equaled an increase of 3.35% but remained at the average level. Reflexive position was realized through content mastering, participating, subjective attitude, and active position in class on the part of the students in the Experimental groups.

The following picture (Figure 5) gives the comparison of self-government before the study (n1) and after the experiment (n2). Integral ϕ (F-test) values are to be < t crit 29.11, p £ 0.01. Empirical ϕ (F-test) values are to be > t crit 2.01 p £ 0.01. The indicators in the Control groups are outside the zone of significance, whereas those in the Experimental groups are significant.

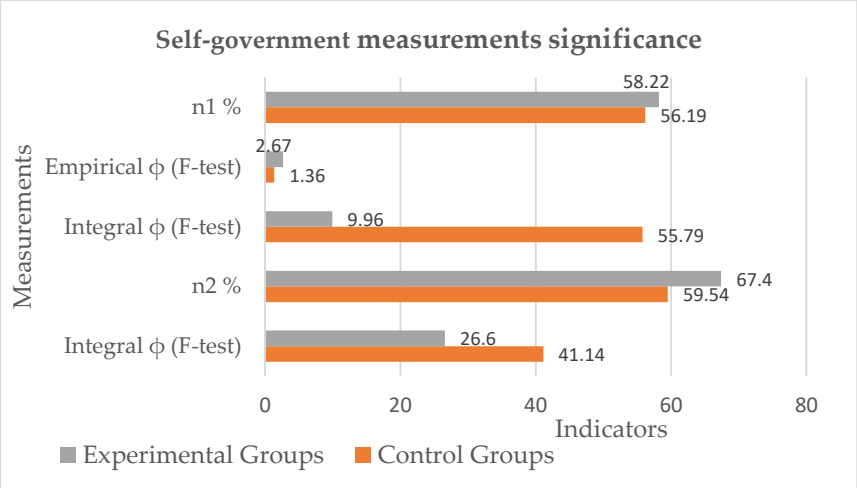

Figure 5. Integral indicators of the ability to self-government.

The variations of self-government ability in the Experimental and Control groups are 7.86%. However, we can observe that the individual spread of this indicator is smaller in the Experimental groups (Figure 6).

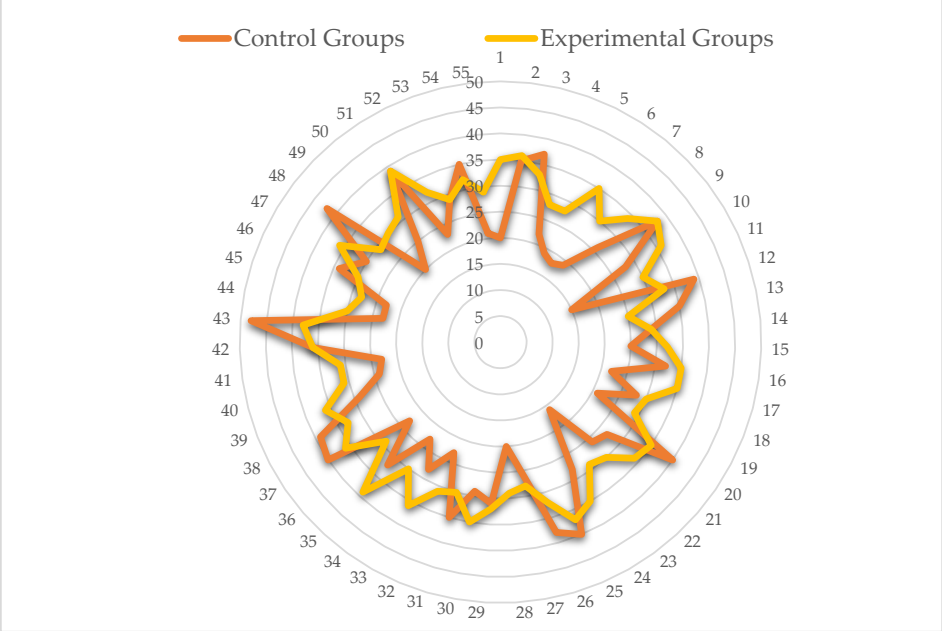

Figure 6. Individual spread of self-government indicators.

The problem of self-government is very acute. Nevertheless, other researchers [41,44,45,48] did not show clear evidence of a transition to self-regulation. On this level, the students were able to consolidate the knowledge and the experience acquired.

4.2. Students' Knowledge Quality

During the ascertaining survey, the students, both in the Control groups and the Experimental groups, showed approximately the same level of knowledge. The difference between the rates did not exceed 3%. We could define the levels from Low to Above average. The lack of High level indicated that the students did not fully master the material being covered.

The data are presented in Table 2. The observations in class let us conclude that "free talk" or free communication posed a major challenge to the students. As such, "learning dialogues" used in class were aimed at involving the students in the learning process. Only the reflexive approach to educational activities makes it possible.

Table 2. Measurement difference of knowledge quality.

Groups		Marks and Levels of Knowledge				
		1	**2**	**2**	**4**	**5**
		Low	**Below Average**	**Average**	**Above Average**	**High**
Control groups	1st survey	12.8%	29.5%	46.8%	11%	0%
	2nd survey	7.3%	14.8%	36.3%	36.5%	5.1%
Measurement difference		−5.5%	−14.7%	−10.5%	+25.5%	+5.1%
Experimental groups	1st survey	15%	29%	45.3%	10.7%	0%
	2nd survey	5.5%	6.6%	14.6%	53.3%	20%
Measurement difference		−9.5%	−20.2	−30.7%	+42.8%	+20%

The students in the Experimental groups show knowledge corresponding to levels "above average" and "high". These levels of knowledge are sufficient in accordance with the curriculum. The Experimental groups' students showed the necessary levels in the amount of 73.5%. Only 41.6% of the Control groups' students could show the same level of knowledge. The received data support the idea that instructional conversations are the tools of cognitive development. They rebuild informal dialogues, for example, when the teacher verbally mediates a student in the process of solving a problem during the lesson. The practical proof of this approach was not found in the literature studied.

4.3. Data Processing

In the last stage, the program was developed to determine the interdependence between personal qualities and the level of the achieved results in the educational process. The main point of the program was to track effectiveness [50–53]. The ability to find new patterns was tested.

The following parameters were used to project estimates (Table 3).

Table 3. Parameters for estimation.

Parameters	Personal Qualities
$x1$	independence, the first test
$x2$	activity, the first test
$x3$	activity, the second test
$x4$	independence, the second test
$x5$	social orientation
$x6$	self-government
$x7$	reflection

Multiple regression line equation of the following type is as follows:

$$y^* = a_0 + a_1x1 + a_2x2 + a_3x3 + a_4x4 + a_5x5 + a_6x6 \quad (1)$$

Factor variables are $x1$, $x2$, $x3$, $x4$, $x5$, and $x6$, and y is an effective sign. According to the results identified, a close relationship between the factors and effective sign takes place [54–56].

This is achieved by finding numerical values of unknown parameters: a0 a1 a2 a3 a4 a5 a6.

We will use the matrix method to find them (Figure 7).

X =	1	67	70	50	45	60	
	1	65	67	48	44	14	
	1	64	38	46	43	13	
	1	66	38	45	43	12	
	1	64	38	44	42	12	
	1	65	38	44	41	12	
	1	63	38	43	40	12	
	1	62	33	42	39	8	
	1	62	32	41	38	7	
	1	41	50	40	35	6	

Figure 7. X—factor feature matrix indicators.

According to the results identified a close relationship between the factor and effective sign (Figure 8).

Y =	5
	4.5
	4.4
	4.3
	4.2
	4
	3.8
	3
	2.7
	2

Figure 8. Y—output feature matrix-column.

To estimate the effectiveness of the change, you need the ratio of performance indicators to the change of factor variables being calculated. Thus, we find for each factor β coefficients. The received indicators help to determine the degree of influence of each factor characteristic on the effective sign [57–60]. The characteristic of elasticity coefficient is then determined, which indicates how much the effective trait will change when the factor trait changes by 1%, according to the formula:

$$e_j = b_j \frac{\overline{x}_j}{\overline{y}} \quad (2)$$

It is illustrated in Figure 9.

	x1	x2	x3	x4	x5	x6
D =	1.86	2.71	0.77	1.57	1.83	0.99
σ =	1.36	1.65	0.88	1.25	1.35	1.001
Aver =	4.001	2.89	2.83	2.75	3.03	2.87
β =	0.413918	0.7223	−0.1733	0.12865	−0.0516	−0.3268
Coefficient of Elasticity	0.409021	0.4265	−0.188	0.095068	−0.039	−0.3168

Figure 9. Coefficient of elasticity.

The practical implementation of the indicators in accordance with the content and methodology can be found in Figure 10. The following information will help you to understand the data correctly (Table 4).

	x1	x2	x3	x4	x5	x6	x7
D =	4.758	1.926	1.545	1.893	0.992	4.751	2.098
σ =	2.181	1.388	1.243	1.376	0.996	2.181	1.448
Aver =	0.017	3.764	3.618	3.673	1.615	−0.053	3.582
β =	1.091	0.411	0.055	−0.052	0.462	−1.231	−0.089
ℓ =	**−0.007**	**0.521**	**0.141**	**−0.122**	**0.661**	**0.027**	**−0.195**

Figure 10. Degree of factors' influence on effective signs in the Experimental groups at the ascertaining stage.

Table 4. Boxes parameters.

Parameters	Personal Qualities
D	dispersion of factor variables
σ	standard deviations of factor variables
Aver	average value of quality level
β	standardized regression coefficient
ι	coefficient of elasticity

Considering the above-mentioned parameters, we can estimate interdependence between personal qualities and quality of knowledge on the example of educational activities of the subject (Figure 10).

Preliminary studies at the ascertaining stage were conducted to check the relative homogeneity of available indicators in the Experimental groups. This is an essential condition for the feasibility of the experiment.

The obtained values of elasticity coefficient show the highest dependency on activity (66%) and personality orientation (66%) on the part of knowledge quality. Dependency on reflection equals 19.5% and ranks third. The fourth place in the proposed sequence is independence (12%). Self-government ability takes the last place and equals 2.7%. Thus, the students under study are at the first level of activity implementation. They can participate in activity only as performers. This level is characterized by coping samples and individual actions within object-subject relationship with a teacher in class. The immediate nature of displaying activities demands activity and the willingness to perform a task (personal orientation) on the part of the student. They are both keys to good academic performance. A notably high dependence on reflection (19.5%) is an attempt to break out of the situational framework for the activity. The students have already got some idea of the learning activities in general, so they try to implement them purposefully and deliberately. The

problem arises with their experience and the personal qualities developed to a sufficient level. The students of the Control group were evaluated at the ascertaining stage as well. The following results support the availability of the experiment (Figure 11).

	x1	x2	x3	x4	x5	x6	x7
D =	4.547	1.631	1.486	1.78	1.22	3.887	2.309
σ =	2.132	1.277	1.219	1.334	1.104	1.971	1.519
$Aver$ =	−0.99	3.927	3.927	3.964	1.547	0.317	3.618
β =	0.542	0.161	0.141	0.047	0.561	−0.719	−0.063
ℓ =	**−0.021**	**0.181**	**0.367**	**0.133**	**0.632**	**−0.093**	**−0.141**

Figure 11. Degree of factors' influence on effective signs in the Control groups at the ascertaining stage.

The received indicators show that the factor attributes by the degree of influence on the effective are arranged in the same order in the Control groups. We can observe only small percentage differences, such as personality orientation (63.2%), activity (54%), reflection (14%), independence (13%), self-government (9,3%). As such, the regression analysis confirms the similar development of personal characteristics and quality of knowledge with the students in all groups before the experiment. In both groups, the quality of knowledge is decisively influenced by activity and personality orientation. The final stage data are presented in Figure 12.

	x1	x2	x3	x4	x5	x6	x7
D =	7.272	0.876	1.421	1.011	1.138	3.151	1.588
σ =	2.697	0.936	1.192	1.005	1.067	1.775	1.26
$Aver$ =	−0.731	4.182	3.873	4.164	1.235	0.348	3.891
β =	0.489	−0.276	0.017	0.049	0.907	−0.963	−0.077
ℓ =	**−0.089**	**−0.396**	**0.037**	**0.136**	**0.704**	**−0.126**	**−0.161**

Figure 12. Degree of factors' influence on effective signs in the Control groups. Final stage.

The coefficient of elasticity at the final stage shows that the order of dependence of knowledge quality on subjective qualities of personality has changed a little: personality orientation (70%), activity (43%), independence (22%), reflection (16%), and self-government (12.6%) in the Control groups.

The degree of dependence of knowledge level on four characteristics has increased: personality orientation (+6.8%), reflection (+2%), independence (+9%), self-government (+3.3%), but on activity has decreased (−11%). Even though students in the Control groups have a certain increase in the level of formation of personality characteristics, they do not yet possess self-consciousness developed to the level of reflection, autonomy, amateur activity, self-management, and self-learning. The last one is followed by a more general quality, openness to self-improvement and self-development, which is lacking. Therefore, the quality of their knowledge depends, first of all, on the desire to perform the task (focus on the task) and the activity with which they perform it. The things are different in the Experimental groups (Figure 13).

	x1	x2	x3	x4	x5	x6	x7
D =	1.317	1.811	0.831	0.967	2.924	31.034	24.761
σ =	1.148	1.345	0.911	0.984	1.711	5.571	4.976
Aver =	4.255	4.164	4.455	4.411	0.886	−5.591	−3.631
β =	−0.041	0.086	0.124	−0.135	0.821	−3.009	2.693
ℓ =	**0.104**	**0.076**	**0.171**	**0.431**	**0.046**	**0.692**	**0.572**

Figure 13. Degree of factors' influence on effective signs in the Experimental groups. Final stage.

The results show that the situation in the Experimental groups has changed dramatically (Figure 14).

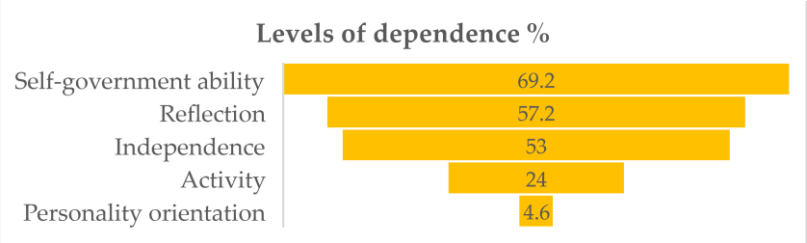

Figure 14. Dependence of knowledge quality on personal characteristics.

We can see an increase with reflection as much as 37.7%. Independence has risen by 41%. The biggest growth occurred with self-government (66.5%). At the same time, activity has decreased by 42% and personality orientation as much as 61.4%. This shows that students in the Experimental groups are acting as subjects of self-development in a joint activity in the field of education. The alignment of self-government indicators in the Experimental groups can be seen as a sign of the students' ability to change their task radically.

The described program is independently developed by the authors. Some other studies in this field are available [7,11,21,25,35,50,51], but they are not specified to show such an interdependence. The theoretical background of the web application is the "Instructional conversation" in class, where students participate as a subject of educational activity. The authors explained and proved the idea of its possibility only in the process of internal speech verbalization, metacognitive strategy, and instructional conversation [50–55].

In the present study, some limitations can be observed. First, the teacher's professionalism is a key point. Thus, it demands assessment. Neglecting this condition might have affected the power of the analyses. Next, the questionnaires demanded openness from the students. Finally, having an instructional dialogue during a lecture seems impossible. As such, the methodology can be applied in a practical class only. That was the reason to choose classes in English. However, the study opens up new horizons for future research. Based on the findings of the present study, we can put forward some investigation for developing the methodology.

The program under discussion really helps the formation of personal properties with a student. Therefore, it should be implemented in practical classes to meet the demands of 'smart education' and 'e-learning', being, as it is, urgent for sustainable education nowadays. We would like to enumerate all its theoretical underpinnings. They are listed in order of general to specific: socio-cultural theory (Vygotsky), the theory of activity and self-development (Rubinshtein, Leontiev), zone of proximal development (Vygotsky), the intrapsychological and interpsychological plans of mental activity (Vygotsky), "participation" pattern (Luria), interiorization and exteriorization (Vygotsky), spontaneous communication in the classroom (Wood, Bruner, Donato), and the theory of the gradual formation of mental actions (Galperin) [56–61].

5. Conclusions

Assumptions on mechanisms of development required empirical verification of the inferences made, namely:

1. One of the most important characteristics of the subject is the ability to transform reality, to change oneself and others through adequate feedback;
2. The subjective properties of a person manifest themselves at a certain level of personality development, providing the possibility of productive activity;
3. Formation of personal characteristics of a student as a subject of educational activity occurs through self-development;
4. Learning activities are an important condition for development;
5. Subject-to-subject relations in class are the possibility of a student's self-development;
6. The program of learning within the framework of socio-cultural theory and "activity" approach is the condition of subjective qualities formation with a personal in the educational activity.

While other theories of mental development believe that the process of learning can be considered without taking into account an active and purposeful mediator, the socio-cultural theory asserts that no number of practical and educational actions (for example, structured information, teacher-controlled speech, exchange of required information, etc.) can break the overwhelming and transforming mediation embodied in a student.

The authors' attitude to the problem solving is likely to follow the "five stage e-moderating model" designed for smart education, that strongly affected higher education environment [60]. The study has been fulfilled in line with the strategy of Education for Sustainable Development Goals being put forward by UNESCO Education Sector [61]. Considering all of the above, the following points can be highlighted to gain educational sustainability. We consider its formation as a sustainable process of building an image of the "World", including the way of actions, thoughts, professions, personal "I" image and personal life, due to internal reasons, the purpose of which is to change the student by him/herself.

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References

1. Vygotsky, L.S. *Educational Psychology*; Classics in Soviet Psychology Series; St. Lucie Press: Boca Raton, FL, USA, 1997.
2. Lee, C.D.; Smagorinsky, P.; Freedman, S.W.; Simons, E.R.; Casareno, A.B. *Vygotskian Perspectives on Literacy Research: Constructing Meaning through Collaborative Inquiry*; Cambridge University Press: Cambridge, MA, USA, 2000. Available online: http://assets.cambridge.org/97805216/30955/frontmatter/9780521630955_frontmatter.pdf (accessed on 1 May 2024).
3. Thompson, I. The Mediation of Learning in the Zone of Proximal Development through a Co-Constructed Writing Activity. *Res. Teach. Engl.* **2013**, *47*, 247–276. Available online: https://library.ncte.org/journals/RTE/issues/v47-3/22712 (accessed on 1 May 2024). [CrossRef]
4. Azi, Y.A. Scaffolding and the Teaching of Writing Within ZPD: Doing Scaffolded Writing (A Short Case Study). *Int. J. Linguist.* **2020**, *12*, 105–114. Available online: https://www.macrothink.org/journal/index.php/ijl/article/view/14044 (accessed on 1 May 2024). [CrossRef]

5. Engestrom, Y. Expansive learning at work: Toward an activity theoretical reconceptualization. *J. Educ. Work.* **2001**, *14*, 133–156. Available online: https://www.academia.edu/30468749/Expansive_Learning_at_Work_toward_an_activity_theoretical_reconceptualization_Engestrom (accessed on 1 May 2024). [CrossRef]
6. Eccles, J.S.; Wigfield, A. From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. *Contemp. Educ. Psychol.* **2020**, *61*, 101859. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X20300242 (accessed on 1 May 2024). [CrossRef]
7. Lee, J.; Zo, H.; Lee, H. Smart learning adoption in employees and HRD managers. *Br. J. Educ. Technol.* **2014**, *45*, 1082–1096. Available online: https://www.researchgate.net/publication/267158127_Smart_learning_adoption_in_employees_and_HRD_managers (accessed on 1 May 2024). [CrossRef]
8. Chaiklin, S. The zone of proximal development in Vygotsky's analysis of learning and instruction. In *Vygotsky's Educational Theory in Cultural Context*; Kozulin, A., Gindis, B., Ageyev, V., Miller, S., Eds.; Cambridge University Press: Cambridge, MA, USA, 2003; pp. 39–64. Available online: https://www.researchgate.net/publication/265047892_The_Zone_of_Proximal_Development_in_Vygotsky%E2%80%99s_Analysis_of_Learning_and_Instruction (accessed on 1 May 2024).
9. Alvermann, D.E. Effective literacy instruction for adolescents. *J. Lit. Res.* **2002**, *34*, 189–208. Available online: https://www.researchgate.net/publication/251502760_Effective_Literacy_Instruction_for_Adolescents (accessed on 2 May 2024). [CrossRef]
10. Ares, N.M.; Percy, M.M. Constructing literacy: How goals, activity systems, and text shape classroom practice. *J. Lit. Res.* **2003**, *35*, 633–662. Available online: https://www.academia.edu/38569696/Literacy_in_the_new_Media_Age (accessed on 2 May 2024). [CrossRef]
11. Salmon, G. *E-Moderating: The Key to Teaching and Learning Online*; Routledge: Cambridge, MA, USA, 2011. Available online: http://lst-iiep.iiep-unesco.org/cgi-bin/wwwi32.exe/[in=epidoc1.in]/?t2000=010909/(100) (accessed on 2 May 2024). [CrossRef]
12. Ryan, R.M.; Deci, E.L. Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemp. Educ. Psychol.* **2020**, *61*, 101860. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X20300254 (accessed on 2 May 2024). [CrossRef]
13. Anderman, E.M. Achievement motivation theory: Balancing precision and utility. *Contemp. Educ. Psychol.* **2020**, *61*, 101864. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X20300291 (accessed on 3 May 2024). [CrossRef]
14. Tso, M.L. The Effects of Teaching Practices on Student's Motivation in Project Learning. Ph.D. Thesis, University of Hong Kong, Pokfulam, Hong Kong SAR, China, 2004. Available online: https://www.researchgate.net/publication/277187999_The_effects_of_teaching_practices_on_student%E2%80%99s_motivation_in_project_learning (accessed on 3 May 2024). [CrossRef]
15. Cole, R.A. *Issues in Web-Based Pedagogy: A Critical Primer*; Bloomsbury Academic: New York, NY, USA, 2000. Available online: https://books.google.ru/books?id=Wik2wRC6bks (accessed on 3 May 2024).
16. Wertsch, J.V. *Voices of the Mind: A Sociocultural Approach to Mediated Action*; Harvard University Press: Cambridge, MA, USA, 1991. Available online: https://archive.org/search.php?query=external-identifier:%22urn:lcp:voicesofmindsoci0000wert:lcpdf:0cc189eb-f9af-40f9-8ebf-3fd67b08aa5b%22 (accessed on 3 May 2024).
17. Meyer, D.K.; Turner, J.C. Discovering Emotion in Classroom Motivation Research. *Educ. Psychol.* **2002**, *37*, 107–114. [CrossRef]
18. Wood, D.; Bruner, J.S.; Ross, G. The role of tutoring in problem-solving. *J. Child Psychol. Psychiatry* **1976**, *17*, 89–100. [CrossRef] [PubMed]
19. Pintrich, P.R.; Schrauben, B. Students' motivational beliefs their cognitive engagement in classroom academic tasks. In *Student Perceptions in the Classroom*; Schunk, D.H., Meece, J.L., Eds.; Routledge: New York, NY, USA, 1992; pp. 149–183. Available online: https://www.semanticscholar.org/paper/Students%E2%80%99-motivational-beliefs-and-their-cognitive-Pintrich-Schrauben/5906d2c682c281b3453c59a309590050844926f7 (accessed on 3 May 2024).
20. Järvelä, S. Shifting research on motivation and cognition to an integrated approach on learning and motivation in context. In *Motivation in Learning Contexts: Theoretical Advances and Methodological Implications*; Volet, S., Järvelä, S., Eds.; Pergamon/Elsevier: London, UK, 2001; pp. 3–14. Available online: https://www.researchgate.net/publication/262581837_Motivation_in_Learning_Contexts_Theoretical_Advances_and_Methodological_Implications (accessed on 3 May 2024).
21. Hattie, J.; Hodis, F.A.; Kang, S.H. Theories of motivation: Integration and ways forward. *Contemp. Educ. Psychol.* **2020**, *61*, 101865. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X20300308 (accessed on 3 May 2024). [CrossRef]
22. Nolen, S.B. A situative turn in the conversation on motivation theories. *Contemp. Educ. Psychol.* **2020**, *61*, 101866. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X2030031X (accessed on 4 May 2024). [CrossRef]
23. Wigfield, A.; Koenka, A.C. Where do we go from here in academic motivation theory and research? Some reflections and recommendations for future work. *Contemp. Educ. Psychol.* **2020**, *61*, 101872. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X20300370 (accessed on 4 May 2024). [CrossRef]
24. Schunk, D.H.; DiBenedetto, M.K. Motivation and social cognitive theory. *Contemp. Educ. Psychol.* **2020**, *61*, 101832. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X19304370 (accessed on 4 May 2024). [CrossRef]
25. Muñoz, E.; García, E.; Puigjaner, L.; Martinez, E. A Systematic Model for Process Development Activities to Support Process Intelligence. *Processes* **2021**, *9*, 600. Available online: https://www.researchgate.net/figure/Blooms-taxonomy-by-Vanderbilt-University-Center-for-Teaching_fig3_350487217 (accessed on 4 May 2024). [CrossRef]
26. Hannum, W.M. E-tivities: The key to active online learning. *Distance Educ.* **2013**, *34*, 395–399. Available online: https://api.semanticscholar.org/CorpusID:3103287 (accessed on 4 May 2024). [CrossRef]

27. Chernova, N.A.; Mustafina, J.N. Instructional conversation as a socially-constructed cognitive tool serves second language learning by mediating its own construction, and the construction of knowledge about itself. *Turk. Online J. Des. Art Commun.* **2016**, *6*, 3114–3117. Available online: https://9lib.net/document/y6eo8d05-instructional-conversation-constructed-cognitive-mediating-construction-construction-knowledge.html (accessed on 4 May 2024). [PubMed]
28. Obermeier, R.; Große, C.S.; Kulakow, A.; Helm, C.; Hoferichter, F. Predictors of academic grades: The role of interest, effort, and stress. *Learn. Motiv.* **2023**, *82*, 101887. Available online: https://www.sciencedirect.com/science/article/pii/S0023969023000188 (accessed on 4 May 2024). [CrossRef]
29. Graham, S. An attributional theory of motivation. *Contemp. Educ. Psychol.* **2020**, *61*, 101861. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X20300266 (accessed on 4 May 2024). [CrossRef]
30. Koenka, A.C. Academic motivation theories revisited: An interactive dialog between motivation scholars on recent contributions, underexplored issues, and future directions. *Contemp. Educ. Psychol.* **2020**, *61*, 101831. Available online: https://www.sciencedirect.com/science/article/pii/S0361476X19304369 (accessed on 5 May 2024). [CrossRef]
31. Chernova, N.A.; Chernov, V.A.; Emelianova, M.B.; Akhunzianova, R.C.; Sukhopluev, D.A. Social-interactive learning concept used for electronic educational resource "post-graduate foreign language" and the obtained learning curve. *Adv. Sci. Technol. Eng. Syst.* **2020**, *5*, 655–659. [CrossRef]
32. Bellissens, C.; Jeuniaux, P.; Duran, N.D.; McNamara, D.S. Towards a Textual Cohesion Model that Predicts Self-Explanations Inference Generation as a Function of Text Structure and Readers' Knowledge Levels. *Proc. Annu. Meet. Cogn. Sci. Soc.* **2007**, *29*. Available online: https://escholarship.org/uc/item/6mr5n71f (accessed on 5 May 2024).
33. Matthews, M.; Cobb, M. Broadening the Interpretive Lens: Considering Individual Development Along with Sociocultural Views of Learning to Understand Young Children's Interactions During Socially Mediated Literacy Events. *J. Lit. Res.* **2005**, *37*, 325–364. Available online: https://www.researchgate.net/publication/234584309_Broadening_the_Interpretive_Lens_Considering_Individual_Development_Along_with_Sociocultural_Views_of_Learning_to_Understand_Young_Children%E2%80%99s_Interactions_During_Socially_Mediated_Literacy_Events (accessed on 5 May 2024). [CrossRef]
34. The Cambridge Handbook of Expertise and Expert Performance. In *Cambridge Handbooks in Psychology*, 2nd ed.; Ericson, R.; Kozbelt, A.; Williams, A. (Eds.) Cambridge University Press: Cambridge, UK, 2018; pp. i–ii. Available online: https://www.cambridge.org/core/books/cambridge-handbook-of-expertise-and-expert-performance/A1BC1FC1B8C8E6FCEE0F4ED2C4E5614D (accessed on 5 May 2024).
35. Yeh, Y.; Kwok, O.; Chien, H.; Sweany, N.; Baek, E.K.; Mcintosh, W.A. How College Students' Achievement Goal Orientations Predict Their Expected Online Learning Outcome: The Mediation Roles of Self-Regulated Learning Strategies and Supportive Online Learning Behaviors. *Online Learn.* **2019**, *23*, 23–41. Available online: https://pdfs.semanticscholar.org/4c35/aa6fb8c36e76d0148069e8aa39644726b8b5.pdf?_gl=1*psmehl*_ga*MTc1MzU4Mjk4LjE2ODUxMTMzMDY.*_ga_H7P4ZT52H5*MTY4NjM5MjU3Ni4xMi4xLjE2ODYzOTI1OTguMzguMC4w (accessed on 5 May 2024). [CrossRef]
36. Calamlam, J.M.; Ferran, F.; Macabali, L.G. Perception on research methods course's online environment and self-regulated learning during the COVID-19 pandemic. *E-Learn. Digit. Media* **2021**, *19*, 93–119. Available online: https://journals.sagepub.com/doi/10.1177/20427530211027722 (accessed on 5 May 2024). [CrossRef]
37. Prasetya, R.E. The Characteristics of Instructional Systematic Design English Online Teaching Environment. *Jo-ELT* **2021**, *8*, 65–72. Available online: https://e-journal.undikma.ac.id/index.php/joelt/article/view/3994 (accessed on 5 May 2024). [CrossRef]
38. UNESCO. *Incheon Declaration and SDG4—Education 2030 Framework for Action*; UNESCO: Paris, France, 2016. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000243278 (accessed on 5 May 2024).
39. Bogdanović, I.Z. Teaching How to Learn. *Probl. Educ. 21st Century* **2018**, *76*, 760–761. Available online: https://www.researchgate.net/publication/330330587_TEACHING_HOW_TO_LEARN (accessed on 6 May 2024). [CrossRef]
40. Arkhipova, I.V.; Baklanov, P.A.; Zhdanov, D.O. Training specialists in humanities at technical college. *XLinguae* **2017**, *l0*, 109–118. Available online: http://xlinguae.eu/2017_10_01_11.html (accessed on 6 May 2024). [CrossRef]
41. Wenglinsky, H. Technology and Achievement: The Bottom Line. *Educ. Leadersh. J. Dep. Superv. Curric. Dev.* **2005**, *63*, 29–32. Available online: https://www.ascd.org/el/articles/technology-and-achievement-the-bottom-line (accessed on 6 May 2024).
42. Meltzoff, A.N. Foundations for a new science of learning. *Science* **2009**, *325*, 284–288. Available online: https://papers.cnl.salk.edu/PDFs/Foundations%20for%20a%20New%20Science%20of%20Learning%202009-4145.pdf (accessed on 6 May 2024). [CrossRef]
43. Paz-Baruch, N.; Hazema, H. Self-Regulated Learning and Motivation Among Gifted and High Achieving Students in Science, Technology, Engineering, and Mathematics Disciplines: Examining Differences Between Students from Diverse Socioeconomic Levels. *J. Educ. Gift.* **2023**, *46*, 016235322211438. Available online: https://www.researchgate.net/publication/367513752_Self-Regulated_Learning_and_Motivation_Among_Gifted_and_High_Achieving_Students_in_Science_Technology_Engineering_and_Mathematics_Disciplines_Examining_Differences_Between_Students_From_Diverse_Socioe (accessed on 6 May 2024). [CrossRef]
44. Guo, H.; Tong, F.; Wang, Z.; Tang, S. Examining Self-Regulated Learning Strategy Model: A Measurement Invariance Analysis of MSLQ-CAL among College Students in China. *Sustainability* **2021**, *13*, 10133. Available online: https://www.researchgate.net/publication/354548760_Examining_Self-Regulated_Learning_Strategy_Model_A_Measurement_Invariance_Analysis_of_MSLQ-CAL_among_College_Students_in_China (accessed on 6 May 2024). [CrossRef]

45. Stoeger, H.; Balestrini, D.P.; Steinbach, J. Self-Regulated Learning for High-Ability and High-Achieving Students in Mixed-Ability Classrooms Throughout the Asia-Pacific. In *Handbook of Giftedness and Talent Development in the Asia-Pacific*; Smith, S., Ed.; Springer: Singapore, 2019; pp. 1–27. [CrossRef]
46. Armstrong, P. *Bloom's Taxonomy*; Center for Teaching, Vanderbilt University: Nashville, TN, USA, 2017. Available online: https://www.edulearn.net.in/wp-content/uploads/2019/10/Blooms_Taxonomy.pdf (accessed on 6 May 2024).
47. Chernova, N.A.; Yevgrafova, O.G.; Antropova, G.; Derdizova, F.; Shakirova, R. Practical implementation of electronic educational resource "post-graduate foreign language" and the investigation findings. In Proceedings of the INTED, Valencia, Spain, 11–13 March 2019. Available online: https://library.iated.org/view/CHERNOVA2019PRA (accessed on 6 May 2024). [CrossRef]
48. Wang, N.; Johnson, W.; Mayer, R.; Rizzo, P.; Shaw, E.; Collins, H. *The Politeness Effect: Pedagogical Agents and Learning Gains*; IOS Press: Amsterdam, The Netherlands, 2005; pp. 686–693. Available online: https://www.researchgate.net/publication/221297334_The_Politeness_Effect_Pedagogical_Agents_and_Learning_Gains (accessed on 6 May 2024).
49. Kim, Y. Empathetic Virtual Peers Enhanced Learner Interest and Self-Efficacy. In Proceedings of the 12th International Conference AIED, Amsterdam, The Netherlands, 18–22 July 2005. Available online: https://digitalcommons.usu.edu/itls_facpub/304/ (accessed on 6 May 2024).
50. Keengwe, J.; Onchwari, G.; Wachira, P. The use of computer tools to support meaningful learning. *Assoc. Adv. Comput. Educ. J.* **2008**, *16*, 77–92. Available online: https://www.learntechlib.org/p/23647/ (accessed on 6 May 2024).
51. Brinkmann, S. *Qualitative Interviewing*; Oxford University Press: Oxford, UK, 2013. Available online: https://vbn.aau.dk/en/publications/qualitative-interviewing (accessed on 6 May 2024).
52. Mohamed, A.; Drean, M.; Couden, J.; Fauroux, J.C. Structural design learning by building reduced models. In Proceedings of the 1st International Engineering and Product Design Education Conference, Delft, The Netherlands, 2–3 September 2004. Available online: https://www.researchgate.net/publication/228554952_STRUCTURAL_DESIGN_LEARNING_BY_BUILDING_REDUCED_MODELS (accessed on 6 May 2024).
53. Garcia, T.; Pintrich, P.R. Student Motivation and Self-Regulated Learning: A LISREL Model. In Proceedings of the Annual Meeting of the American Educational Research Association (ED), Washington, DC, USA, 3–7 April 1991. Available online: https://files.eric.ed.gov/fulltext/ED333006.pdf (accessed on 6 May 2024).
54. Fuller, D.; Sedo, D.R. "And then we went to the brewery": Reading as a social activity in a digital era. *World Lit. Today* **2014**, *88*, 14–18. Available online: https://link.springer.com/chapter/10.1007/978-3-030-48244-2_14 (accessed on 6 May 2024). [CrossRef]
55. Thomas, D.M. Examining the Academic and Motivational Outcomes of Students Participating in the READ 180 Program. Master's Thesis, University of Kentucky, Lexington, KY, USA, 2005.
56. Chernova, N.A.; Mustafina, J.N. Electronic Educational Resource "Post-graduate Foreign Language" and the Obtained Learning Curve. In Proceedings of the DeSE, Paris, France, 14–16 June 2017. [CrossRef]
57. Chernova, N.A.; Emelianova, M.B.; Trukova, A.; Bolshakova, S.V.; Matveev, S. Testing the program determining the impact of teaching methodology on a student's formation as a subject of educational activity. In Proceedings of the DeSE, Liverpool, UK, 13–17 December 2020. Available online: https://ieeexplore.ieee.org/document/9450768 (accessed on 6 May 2024). [CrossRef]
58. Horton, W.; Horton, K. *Electronic Education: Instruments and Technologies*; Kudits Publishing House: Moscow, Russia, 2005; pp. 150–640. Available online: https://knigogid.ru/books/1203147-elektronnoe-obuchenie-instrumenty-i-tehnologii (accessed on 6 May 2024).
59. Martin, R.C. *Clean Architecture: A Craftsman's Guide to Software Structure and Design*; Prentice Hall: Upper Saddle River, NJ, USA, 2017; pp. 120–432.
60. Wright, P. Comparing E-tivities, e-Moderation and the Five Stage Model to the Community of Inquiry Model for Online Learning Design. *Educ. Sci.* **2014**, *4*, 172–192. Available online: https://files.eric.ed.gov/fulltext/EJ1117922.pdf (accessed on 6 May 2024). [CrossRef]
61. Education for Sustainable Development Goals: Learning Objectives; UNESCO: Paris, France. 2017. Available online: https://www.unesco.de/sites/default/files/2018-08/unesco_education_for_sustainable_development_goals.pdf (accessed on 6 May 2024).