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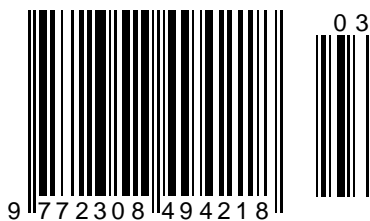
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METACOGNITION IN CHEMISTRY EDUCATION

Abstract: *The study determined the cognitive and affective effects of metacognitive activities. Specifically, it sought answers to define the subjects' chemistry performance, motivation, and scientific attitude before and after the exposure to the intervention, to find out the significant improvement in the given parameters, and to design improved instructional activities in the light of the findings. The quasi-experimental study used the one group pretest-posttest design to answer the problems posed. At the outset, the cognitive and affective levels of the 42 subjects were determined. To find out the cognitive effects, a chemistry performance test developed by the researcher and validated by panel of experts was used. Chemistry Motivation Questionnaire and Science Attitude Inventory II were used to determine the subjects' affective status. After the intervention period, the subjects' exit competence was determined and differentiated from the pretest level. Through the t-statistic for paired observations, the difference between the tests was computed for the level of significance. As the final output, an enhanced instructional guide on integrating activities for metacognitive development among chemistry students was designed. There are seven metacognitive activities that were utilized in the present research undertaking, namely: Learning Portfolio (LP), Metacognitive Planning/Feedback/Discussion, Metacognitive Wrapper, Session Reflection Log, Goal-setting, Metacognitive Note-taking, and Learning Community. The activities correspond to specific episodes of the instructional cycles and were tweaked with the intent of purposefully helping students develop metacognitive skillfulness. It is recommended that related studies be explored to determine the effect of a prolonged exposure of the students to the different metacognitive activities. Chemistry teachers may also adopt activities which are known to effectively assist students in conceptual development of abstract concepts in Chemistry and if situations permits, subjects be taught with laboratory following the science inquiry philosophy. Further, course and class advisers should encourage students to write their goal statements. Schools should also provide ample and varied opportunities for students to succeed and move up in the academic rung. Schools can design online or semi-online platform to cater to working students, second coursers, and working professionals whose circumstance could hamper in their maximum compliance and access to classroom activities. Lastly, to make science relevant to career and the personal lives of the non-science majors, academic programs such as environmental science or science, technology, and society may be offered in lieu of non-laboratory Physics and Chemistry.*

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Introduction

The need to teach our students to become self-propelling learners has become a global catch-cry. However, if our classrooms are to succeed in this tall order, we have to regard our students as partners in facilitating learning. They have to be taught as good managers of their own successes in the classroom and beyond. Our pedagogical processes should be designed so as to empower students to effectively manage their own learning. Students should share a sense of accountability of their own academic success. Processes such as planning how to approach a course or a chunk of topic, monitoring one's progress in the course including taking necessary steps for improvement after a thoughtful reflection of the learning experience should be manifested in our classrooms. In actual practice though our classroom processes presupposes that teachers do the planning, monitoring, and evaluating activities in the classroom to ensure students' academic success. Many teachers would agree that when students exercise these functions success rate in the classrooms is likely to increase. The researcher believes that every student under proper training and feedback will consciously endeavor to become self-propelling learners: leaners as "reflective practitioners" of his or her own learning. The key for this cogent point is teaching for metacognition. Metacognition is a term used to mean one's thinking about his thinking processes or what cognitive psychologists consider as second order cognition. Purposive thoughts about one's own thought processes or reflecting the different events and actions in life and their ramifications are few instances when one becomes metacognitive. Recently, though, it has come to encompass variables in the affective realms and the learners' conscious and deliberate intent to do self-regulating processes (Louca, 2008). Reviewed researches around the globe echoed the impact of metacognition in promoting learnig in the different disciplines (Pulmones, 2002, Lin et. al, 2005, Cooper, 2009, Chalmers, 2009, Chalmers &Nason, 2003, Tanner, 2012).

In the classroom settings, instructors can help students develop metacognition by asking them about their learning processes and reflect on what they practice (Anderson, et. al., 2010). Along this line, Cornford (2012) suggests that learning events in the class must provide activities that will compel students to be reflective learners. This can be done through assessments of one's weaknesses or strengths and drawing lessons from such an experience. In fact Pulmones (2015) found out that when students are exposed to this kind of activities rather than in straight forward manner, students did not only enjoy it, but they also showed improvement in terms of performance and metacognitive skillfulness.

Recent studies have explored on how activities that foster metacognitive development can be integrated in different courses in the tertiary level viz: Promoting Student Metacognition in College Biology Course, Tanner 2012; The use of metacognitive wrappers in chemistry assignments, Lovett, 2008; Designing Metacognitive Activities, in 2001; Teaching Chemistry in metacognitive environment, Pulmones, 2007. Their findings tend to suggest the effectiveness of these activities in promoting the cognitive and the affective aspects of learning the course. Two constructs which are very important if we were to imbue our students with life skills.

Attitudes and motivation are two essential affective components that are known to influence students learning (Sirhan, 2007). These variables are in fact intertwined. One who has positive attitude towards learning tends to be motivated and thus may put more effort in the different learning tasks. In fact students who have high self-efficacy exemplified great performance in different learning tasks (Nbina, J. B., & Viko, B., 2010)

One of those learning areas that could benefit from this nascent development in pedagogy is the general education courses particularly conceptual subjects such as Chemistry.

Chemistry is of the branches of natural sciences. Its role in shaping the technological landscape cannot be denied. Because its contribution permeates in the realm of other sciences such as Biology, Physics, Nutrition, Health and other disciplines, it is often regarded as the central science. However; against this backdrop, chemistry education as an academic discipline is in decline internationally. Similar trends have been observed across the globe. Price & Hill (2004) reported in their surveyed literature in chemistry education this alarming pattern in Japan, Australia, Unites States, and the United Kingdom. In the Philippine tertiary schools Chemistry is taught as one of the general education courses together with physics, biology and geology. 'The chemistry portion presents the basic theories and principles of chemistry, their historical development and applications (Padolina & Magno, 2015). Chemistry is oftentimes perceived as a difficult subject – a shared assessment of students in secondary and higher institutions of learning. This is even true particularly to non-science major students whose only compelling reason to take the course is graduation (Breuer, 2002). This observation is particularly relevant in as much that students who are enrolled in the researcher's classroom are non-chemistry major. Oftentimes, students, especially those who have unpleasant high school chemistry experience, meet the subject with much skepticism and resistance.

The difficulty can be attributed to the students' failure to have a theoretical grasp of the chemistry lessons (Sirhan, 2007 and Ali, 2014). Although, there are several variables to consider why meaningful learning in chemistry classroom is scarce, reviewed literatures would agree that the main obstacle lies in the students' shallow understanding of the

fundamental concepts of the course. These difficulties block the students' ability to effectively navigate in a deeper investigations and more demanding investigation in the course (Sirhan, 2007 p4 and Alir, 2014).

The problem is even confounded by the nature of students who enter our classrooms. As observed by the researcher, being a teacher for almost ten years and from information gathered from interviews with the student welfare and guidance offices personnel, it has been noted that students in his workplace generally show poor study habits, that is, planning for their lessons and other study strategies for survival in the rigorous demand by the academe and later on as an IT (information technology) professional. This is understandable because of the open admission policy of the school.

Analyzing the academic performance of students in science subjects, that is, physics and chemistry from 1990's up to present would show that failing percentage revolves around 1% to 8% of the population enrolled in every semester with few exceptions on two or three semesters when the failing percentage has reached 14 to 16 percent. Closer data analysis; however, showed that while students indeed passed these science subjects, majority of them clustered in the segments with grades of 2.5 to 3.0. This means that students are struggling to grasp the concepts in physics and chemistry. Whether the cause is cognitive in nature or how ready the students are in facing college science academic demands or students' attitude toward science and science instruction, this dismal performance calls for some reforms.

This bleak reality calls for restructuring of teaching-learning processes in such a way that both conceptual understanding of the course is achieved as well as the development of the life skills that are transferable across the disciplines or even in the personal lives and career of the students beyond the academia. It is the contention of the researcher who is handling introductory chemistry course in a tertiary institution that instructors should purposefully incorporate and emphasize activities that promote metacognitive skillfulness among students. It is with these two fronts; teaching for chemistry understanding and teaching for metacognition (or teaching for metacognitive skillfulness) that the researcher has embarked in this study.

Methodology

This study aimed in finding out the cognitive and affective effects of metacognition. The present study used the experimental design specifically the one-group, pretest-posttest design to find out if there was a significant difference in Chemistry1 students' chemistry performance, metacognitive awareness, motivation, and scientific attitude before and after the exposure to the metacognitive activities.

The research subjects were second year students enrolled in Chemistry 1 course, first semester, school year 2016-2017. They were students who were in their third semester (second year, first semester) in the Information Technology program.

Verbal and non-verbal abilities. The researcher requested the profile of the participants from the office of the guidance and testing center of the school. As shown in the report, 69.23% of the total research participants manifest difficulty in perceiving the relational aspects of words and word combination. They also have trouble in understanding subtle differences among similar words and phrases as well as manipulate words to produce meaning. Data based on relevant psychometric test also showed that they have difficulty in using number to predict outcomes according to computational rules. However, around 38.46% of the students are able to comprehend and employ numbers that make them understand its relationship and manipulate spatially.

The current study attempted to find out the cognitive and affective effects of metacognition. To describe and measure the extent of effects of these variables the following tools were utilized in this study:

Cognitive Effect

Chemistry Achievement Test. To obtain the performance profile of the students in chemistry, a teacher-made test was used in this study. To ensure the validity and reliability of the test, the expertise of colleagues and other specialist in the field was sought. To check for readability and clarity, the tool was pilot tested to science major students of Cebu Normal University. Appropriate corrections were carried out based on the suggestions and recommendations both by the students, in terms of "comprehensibility" and usability of the tool, and the experts in terms of the validity of the items until a reliability index of $\alpha = 0.89$ is achieved.

Affective Effect

Science Motivation Questionnaire (SMQ) by Shawn M. Glynn and Thomas R. Koballa, Jr. This Likert-scale questionnaire developed by Glynn and Koballa was used in this study to assess the motivation profile of the students. It is a checklist with thirty (30) statements and corresponding responses of never (1), rarely (2), sometimes (3), often (4), always (5). The thirty item-science motivation questionnaire is subdivided into six components of motivation, namely: (a) intrinsically motivated chemistry learning (items 1, 16, 22, 27, 30); (b) extrinsically motivated chemistry learning (items 3, 7, 10, 15, 17); (c) relevance of learning science to personal goals (items 2, 11, 19, 23, 25); (d) responsibility; that is, self-determination for learning chemistry (items, 5, 8, 9, 20, 26); (e) confidence; that, self-efficacy in learning science (items 12, 21, 24, 28, 29); and, (e) anxiety

about chemistry assessment (items 4, 6,13, 14, 18). The items about chemistry assessment are reversed scored. The SMQ maximum total score is 150 while the minimum is 30.

Scientific Attitude Inventory (SAI II). The Scientific Attitude Inventory II developed by Richard W. Moore and Rachel Leigh Hill Foy was utilized to assess the students' scientific attitudes. The SAI II has 40 Likert-type attitude statements and 12 position statements. Six positions are positive and are labeled 1-A through 6-A. Six are negative and are labeled 1-B through 6-B. The A and B pair for each position are opposites of each other. The useful scales for analysis are 1-AB through 6-AB for each position and the positive and negative scales consisting of 1-A through 6-A and 1-B through 6-B, respectively. The SAI II is scored by assigning point values to each of the attitude items. Scores for the various subscales can be determined by adding the scores for the respective items. Scores may be determined for the 12 subscales, a total for the positive items, a total for the negative items, and a total for the entire SAI II. The range of scores for each of the scales1-A through 5-B is 3–15 (1–5 points X 3 items). The range of scores for scales 6A and 6B is5–25 (1–5 points X 5 items). The range of scores for the entire SAI is 40–200 (1–5 points X 40 items).

Metacognitive Awareness

Metacognitive Activities Inventory (MAI). To measure the students' metacognitive awareness, a metacognitive activities inventory (MAI) was used in this study. The Metacognitive Activities Inventory is a self-report developed by Schraw and Dennison (1994) that allows to measure adults' metacognitive awareness. Items were classified into eight subcomponents subsumed under two broader categories: knowledge of cognition (metacognitive knowledge) and regulation of cognition (metacognitive skillfulness).

Results and Discussion
Status of Subjects Before Exposure to Metacognitive Activities

Every student who enters the portals of our classrooms brings with him or her preconceived notion about anything that is to be learned. They carry with them earlier experiences, understanding and misconceptions, feelings, and beliefs about the subjects to be learned and about themselves. Knowing these background knowledge and misconceptions is critical since they are usually enduring and difficult to purge (Arends and Kilcher, 2010). These factors along their personal perspectives of how well they would fare in the course may help or impede the level of engagements students are willing to take in the classroom. It is therefore imperative to find out the entry status of the subjects before the exposure to the intervention.

Affective Aspects of the Study: Motivation and Scientific Attitude

Earlier works on metacognition focused mainly on the role that metacognition in academic achievements. It is the contention of the present study that affective components play an integral role in making students thrive in Chemistry classrooms. For us to be effective facilitators of learning, knowledge of students drives and attitude towards Chemistry and science in general becomes imperative. The tables that follow show the affective components of the subjects based on the pretests.

Table 1. Summary of Entry Level Motivation

Subcomponent	Mean	SD	Description	Rank
Intrinsic	3.862	0.522	Very High	1
Self-determination	3.5238	0.4994	Very High	2
Extrinsic	3.3524	0.6134	Very High	3
Relevance to Personal Goals	3.2714	0.4994	Very High	4
Anxiety about Science Assessment	3.0524	0.6310	High	5
Self-efficacy	3.0333	0.5707	High	6
Totality	**3.3492**	**0.5607**	**Very High**	

The entry level motivation of the subjects is shown on Table 1. It can be noted that the subjects' intrinsic motivation tops all the subcomponents. This means that Chemistry students entered into the classroom with "Very High" motivation to learn the course. One might wonder where this motivation is rooted when in fact as narrated earlier Chemistry is a difficult subject. Moreover, the entry chemistry competence is below average which therefore would have been symptomatic of a "poor motivation level". One way to look at it is the innate desire of the students to able to demystify the puzzling nature of

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macroscopic phenomena in the light of molecular or symbolic world. For instance, students are intrigued of these common observations :"sir unsa'y kalahian sa iron sa bike ug iron sa dugo?" [sir, what's the difference between the iron found in our blodd and the ironfound in the bicycle?], "kanang, nganu tay-un man ang puthaw sir, pero ang aluminum dili lagi? […why does iron rust while aluminum doesn't?]. Questions like these provide some level of cognitive dissonance; hence, a higher level of intrinsic motivation. For classroom practice, this could mean that teachers should provide activities that highlight chemistry's practical applications in understanding the "mysteries" of world they live in.

Meanwhile, as revealed in table 4, the subjects' self-determination is "Very High". The subjects are aware to some extent that there are factors both those that involve themselves and those that are external that cause their successes or failures in earlier chemistry experiences. These factors include ability, effort, luck, and difficulty of the learning task (Weiner,1972). Extrinsically, Table 4 shows that the subjects are "Very Highly Motivated". Being a general education course, students do not necessarily feel that this subject is related in information technology program. This is even highlighted in the post interview script shown later. So what drives them to learn? Grades and graduation. After all, these two are the driving forces that propel them to enroll in the course. Many of the students are working scholars, food chain crew, and office staff. Therefore grades have to be maintained for them to stay as a scholar. Further, they feel that they have made big investment for the subject. It is therefore imperative to pass it or even earn a good mark.

In terms of relevance to personal goals, Table 4 reveals the subjects' "Very High Motivation" entry level. This could be viewed that in general, learning chemistry has its practical purpose or significance in the lives of our students who enter our classrooms. However, anchoring chemistry in the purpose or goals of the program where the subjects are enrolled might prove to be slightly challenging. How to prepare classroom materials and raise the level of discussion in chemistry that is attuned to the personal goals of the students is a valuable consideration in Chemistry instruction.

On top of the students' cause of anxiety are the chemistry examinations. This could be explained by the fact that results in examinations have implications not only in their social status in the class but also in the ultimate performance in the course. As presented, students are generally "Highly Motivated" consistent with other sub components in motivation. However; it is seen to be slightly lower in the spectrum. This means that while they have high confidence in learning chemistry lessons, assessment still creates a stigma among the students.

In all the motivation components, self-efficacy is relatively lower. Nonetheless, the subjects are still "highly motivated". This could mean that students may feel relatively less confident that they will succeed in the class. This could be a good target behavior using the metacognitive activities as a tool to develop learners to take control of their own learning.

Scientific Attitude Level Prior to the Intervention

Attitude towards science or as used in this study, scientific attitude, can be defined as the feelings, beliefs, and values held about an object that may be the endeavor of science, school science, the impact of science and technology on society, or scientists (Akcay, Yager, Iskander, & Turgut, 2010, p1). The subjects' attitude toward science may give us some insights and clues as to how students will fare in Chemistry instruction.

Table 2. Summary of Pretest for Scientific Attitude

Position Statement	Mean	SD	Description	Rank
5AB *Progress in science requires public support in this age of science; therefore, the public should be made aware of the nature of science and what it attempts to do. The public can understand science and it ultimately benefits from scientific work.*	3.6310	0.6121	Strongly Positive	1
2AB *Observation of natural phenomena and experimentation is the basis of scientific explanation. Science is limited in that it can only answer questions about natural phenomena and sometimes it is not able to do that.*	3.3532	0.4327	Strongly Positive	2
3AB *To operate in a scientific manner, one must display such traits as intellectual honesty, dependence upon objective observation of natural events, and willingness to alter one's position on the basis of sufficient evidence.*	3.3056	0.5086	Strongly Positive	3

6AB *Being a scientist or working in a job requiring scientific knowledge and thinking would be a very interesting and rewarding life's work. I would like to do scientific work.*	3.2214	0.5732	Strongly Positive	4
1AB *The laws and/or theories of science are approximations of truth and are subject to change.*	3.1984	0.3458	Strongly positive	5
4AB *Science is an idea-generating activity. It is devoted to providing explanations of natural phenomena. Its value lies in its theoretical aspects.*	3.1587	0.4131	Moderately Positive	6
Total	3.3114	0.4809	Strongly Positive	

Table 2 shows the subjects' attitude towards science as determined by the position statements in the Scientific Attitude Inventory II (Moore & Foy, 1997) prior to their exposure to the intervention. Position statement 5AB "p*rogress in science requires public support in this age of science; therefore, the public should be made aware of the nature of science and what it attempts to do. The public can understand science and it ultimately benefits from scientific work"* tops the rank and merit a "Strongly Positive" attitude from the subjects. It can be construed that the subjects strongly believed that the every citizen should understand science. This is expected because the subjects, being Information Technology students, are bombarded everyday by different technological advancement in the field of computer. Both the production of materials they use and themselves as co-creator of software and other related IT products and services expatiate science as a human enterprise. Settled at the bottom of the ranking; however, is position statement **4AB** rendering it to be "Moderately Positive". This finding could mean that subjects agree lightly (mean = 3.1587) on the attitude statements pertaining to science as an idea-generating activity and the nature of theoretical systems that operates in science. This could be because students who are entering in the chemistry course viewed highly the most practical contribution of science such as development of materials for modern infrastructure, technology, medicine, and other inventions of practical value to society. Just like many of us, the research subjects are consumers of knowledge and technology and often have less understanding or exposure to the creative inventions of theoretical systems that operates in the scientific endeavors. On the average the subjects showed a "Strongly Positive Attitude" towards science. This is expected because the subjects are bombarded by plethora of scientific materials, be it gadgets or news, environmental issues, pollution, health, advancement in military warfare, and space exploration. More so that they are information technology students, access to these materials is within the reach of their fingertips. In other words, science and its contribution to humanity has become part and parcel of our students' collective consciousness thereby creating a good environment for the subjects to have "Strongly Positive" attitude towards science.

Chemistry Performance Before the Intervention

Table 3. Subjects' Entry Level Chemistry Performance

Skills	N	Mean	SD	Description	Rank
Periodic Table	42	2.381	1.652	Average	1
Electronic Structure	42	1.833	1.286	Average	2
Formula Writing	42	1.405	1.083	Below Average	3
Naming	42	1.095	1.031	Below Average	4
Quantum Numbers	42	0.667	0.687	Poor	5
Totality	42	1.4952	0.7448	Below Average	

Table 3 shows the subjects' performance in the chemistry pretest. It can be gleaned that the students' overall entry competence is below average (mean = 1.4952). Further, it showed that students struggled in quantum numbers but showed an average performance on items relating to periodic table and electronic structure, and "Below Average" for formula writing and Naming of inorganic compounds. Similar conceptual difficulties have been reported in earlier chemistry education researches (Maningo, 1999; Sirhan, 2007, Cardillini, 2012, Gafoor & Shilna, 2013). Students come to chemistry classrooms with conceptual difficulties. Students find it difficult to understand moles, atoms, quantum numbers (Maningo, 1999) periodic table and chemical bonding (Gafoor & Shilna, 2013) and related concepts that require a higher level of abstractions. The subjects' entry level competence may provide us some clues into the nature of concepts the students mastered in high school chemistry. Where the difficulty lies and what this means to college chemistry teaching? Key in finding answer to these questions is the very nature of chemistry concepts. Chemistry exists in three forms: the macro and tangible that is, what can be seen, touched, and smelled; the submicro that includes atoms, molecules, ions, and structures; and the representational that involves symbols, formulae, equations, molarity, mathematical manipulations and graphs (Johnstone, 2000 & Chang, 2000). Students come to our classroom replete with experiences of the macroscopic world. What they see, touch, manipulate and feel. This makes chemistry as a course that we all can relate well. However, for chemistry phenomena and processes to be fully understood students have to be engaged with activities that reach the submicro and representational levels. In fact many observable phenomena that seem to be a mystery are ably understood and expounded at this level. Johnstone (2000) believes that this is the strength of chemistry as an intellectual pursuit but a task that proves to be challenging among students. Another reason for such dole performance could be the kind of learning experiences that students have engaged in earlier chemistry classes. Where the lessons taught in a way that the three touch points of macroscopic, submicroscopic, and representational levels are best addressed? Ali (2012) underscores the importance of students' basic understanding of the learning situation, in this case, chemistry, because it may have direct effect coping with the advanced level knowledge. In this study, students wrote short essays on their earlier chemistry encounters. Although the students' comments shown on the table below is not everything about their previous chemistry lessons, it gives an insights of students personal journey, struggles and triumphs of chemistry before entering our college chemistry classrooms. Laboratory activities that draws in curiosity and support to the abstract nature of the Chemistry, the teacher's disposition and strategies of teaching are recurring themes that highlight the students earlier chemistry experience.

Another important consideration for the subjects' dismal performance could be the time when the subjects have been exposed to Chemistry lessons. It is worthy to note that it was in their 3rd year in high school or roughly three years since that they took the Chemistry performance test. The subjects may have difficulty recalling the different concepts learned. With these insights; college instructors may provide innovative teaching strategies that would both help reignite students' interest and at the same time present the subject cognizant of the touch points of chemistry learning presented.

Metacognitive Awareness Before the Intervention

One of the aims of this research endeavor is to assess the level of metacognitive awareness of the subjects prior to exposure to the metacognitive activities in chemistry instruction. One's metacognitive level of awareness is divided into two areas: knowledge of cognition or metacognitive knowledge and regulation of cognition also known as metacognitive skillfulness. Metacognitive knowledge refers to the awareness of one's thinking while metacognitive regulation is the ability to manage one's own thinking processes (Darling-hammond, et al, 2003). Metacognitive knowledge that includes, declarative, procedural and conditional are found in table 2, while the five metacognitive skillfulness components, that is, planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation are presented on table 3. The sub skills or performance indicator for each sub components were removed for simplicity of discussion. It can be gleaned from the tables that students are "Excellent" on the average in both metacognitive knowledge and skillfulness; yet when this is juxtaposed with their dismal performance in Chemistry Pretest, there seems to be some cognitive incongruity. This tends to run against the grain of findings of earlier researchers as it will be discussed later that high metacognitive awareness are high predictors of academic success. One may think that students sporadically answer haphazardly the questionnaire; However, this could not be the case because accomplishing the pre-tests as well as posttests was thoroughly explained and monitored by the researcher. An earlier work may provide answer to this dilemma. Lovett's (2008) earlier research on students' metacognitive skills and beliefs provide enlightenment to the current finding. She found out that students tend to overestimate their abilities or become overconfident about what they can do. New strategies that fosters for self-regulating behavior are suggested to address both cognitive and affective concerns, that is, overconfidence. Another way to look at it is that, students have their personal

understandings of themselves, chemistry as a subject – ease or difficulty, and their "generic belief" about the use of strategies. This could mean that subjects enter the classroom loaded with their previous experiences, realizations, and insights that old routines may no longer work and as well as new (Dawson, 2008). This could mean that teachers can ably help students maximize this knowledge to achieve learning goals. Arends and Kilcher (2010) suggested that knowledge about the types of

knowledge the students' are well verse or oriented has instructional significance because it helps determine the type of teaching strategy for a particular lesson. A student who is "overconfident" may be given challenging tasks paired with activities that provide opportunities for reflection. On the other hand student who is visually oriented may use concept maps as a way to understand and remember important information, or a student who is not good in memorizing long lists of names may use mnemonics.

Table 4. Summary of findings for Metacognitive Knowledge

Metacognitive Knowledge	N	Mean	SD	Description	Rank
Conditional	42	3.4849	0.5668	Excellent	1
Declarative	42	3.4179	0.5832	Excellent	2.5
Procedural	42	3.4179	0.5668	Excellent	2.5
Totality	**42**	**3.4402**	**0.5723**	**Excellent**	

Table 4 reveals the subjects metacognitive knowledge prior to the intervention. In general, the subjects who entered in the Chemistry classroom showed an "Excellent" metacognitive knowledge. This implies that our students come into our classrooms fully aware of what of their own capabilities and limitations. When accessed by the teacher, this information of students' interest, motives, and pitfalls could be utilized in designing instructional activities that are cognizant of these realities. For example when the students are beset with the challenge in managing information and organizing data, teachers can ably infuse classroom activities that would target these skills alongside learning chemistry. In terms of procedural knowledge, the students are "Excellent". This is expected because when the subjects come into chemistry classrooms, they have had problem-solving encounters. Hence they have a repertoire of learning strategies in earlier years of school in several subject areas. The automaticity in deploying these strategies though, "Excellent", appears to be slightly lower. One reason could be that knowledge and dealing with problems is

"conditionalized" (Bransford,, Brown, & Cocking, 2000) . This could explain, too, the disparity in the Chemistry performance and the metacognitive awareness. Using a strategy requires context, specificity, and applicability. The students may show excellent knowledge and skills in programming or mathematics subjects, for example, but may find it challenging to solve things in Chemistry activities. One imperative in our teaching learning activities; therefore, is to allocate time for formative activities that fosters the development of these skills among our learners. Table 4 further shows that the subjects have "Excellent' conditional knowledge. This means that they learn best when they have full grasp of the topic to be learned and tasked to be accomplished. Essential to the success in chemistry lessons and beyond is the subjects' ability to use the appropriate declarative and procedural knowledge in different chemistry tasks. This means that it is not enough that students acquire knowledge; knowing when and where to use it to achieve one's ends are equally important (Turns and Van Meter, 2011).

Table 5. Summary of Findings for Metacognitive Skillfulness

Metacognitive Skillfulness	N	Mean	SD	Description	Rank
Planning	42	3.5748	0.5762	Excellent	1
Debugging	42	3.4961	0.4559	Excellent	2
Evaluation	42	3.4747	0.4636	Excellent	3
Strategy	42	3.4522	0.4776	Excellent	4.5
Monitoring	4	3.4522	0.4775	Excellent	4.5
Totality	**42**	**3.4874**	**0.4084**	**Excellent**	

As a whole, the entry level metacognitive skillfulness of the subjects is "Excellent". Top on the rank is the students' planning skills with a mean, followed by the debugging, evaluation, and lastly strategy and monitoring. A detailed analysis and discussion on the metacognitive knowledge and skillfulness will be devoted in the contrasting of pretest and posttests.

Integration of Metacognitive Activities in Chemistry Instruction

The metacognitive activities were integrated in the teaching learning activities (TLAs) in the Chemistry 1 lessons. Figure 3 shows a simplified three-step flow of Chemistry instruction integrating these activities.
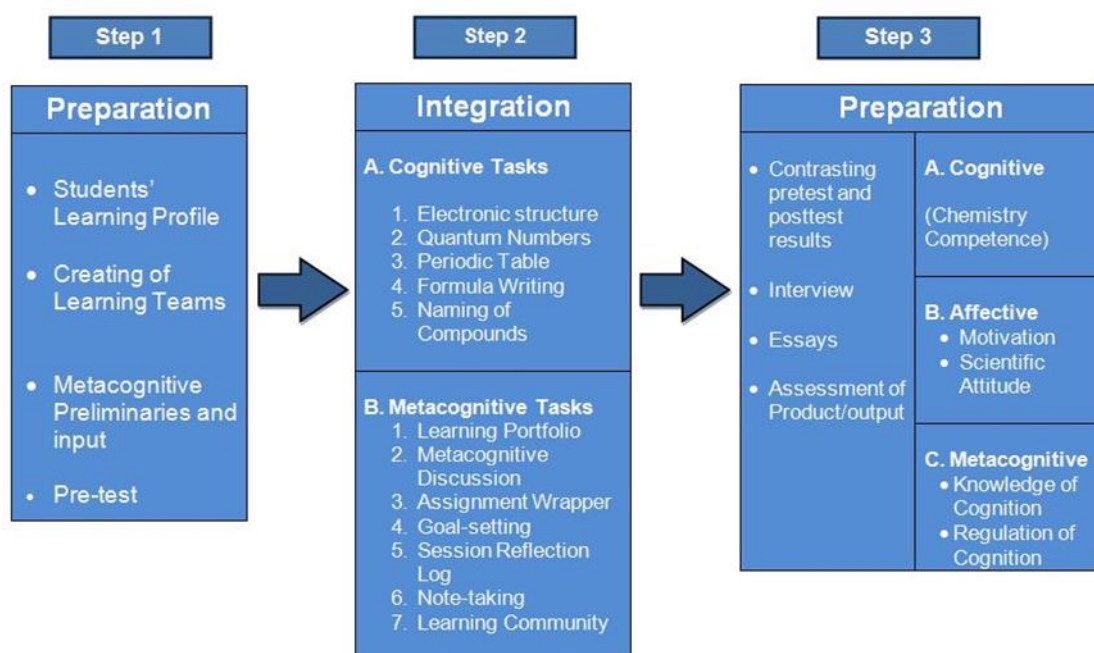

Figure 3. Implementation Flow of Metacognitive Activities

Step 1 is *preparation* which intended to prepare the class for the integration. It involves assessing the students' learning status which will be of great help in the creation of learning teams, and then students took the pretests. This was followed by mini-training on metacognition and self-regulated learning. In the present study, the students developed their own Cornell notes from recycled papers. Rubrics for assessing the quality of products were also presented and negotiated in the class. After seeking for clarifications the class was ready by this time for the integration proper. In *step 2*, *integration*, the students faced two instructional tasks: a) cognitive tasks which refer to the different chemistry activities like electronic structure, quantum numbers, periodic table, formula writing, and naming compounds; b) metacognitive tasks that include learning portfolio, metacognitive discussion, assignment wrapper, session reflection log, goal-setting, and learning community. *Step 3*, is the checking on the effectiveness of the chemistry instruction. This stage, *evaluation,* requires observations of behavior changes in the subjects: the cognitive, affective, and metacognitive effects referred to as the center piece problem of the current research endeavor. This was

done by providing different assessment tasks like written self- assessment, interviews, and products. The teacher also contrasted the pretest and posttest results to see significant improvements in the subjects' status. The findings and there implications will facilitate teachers and instruction implementers to feed forward for an improved chemistry instruction. In this framework, skills or conceptual development in Chemistry are achieved alongside the different metacognitive tasks. **Figure 4**, shows the constructive alignment of teaching learning activities (TLAs), intended learning outcomes (ILOs), and assessment tasks (ATs) that served as the guide posts in skill development. At the heart of metacognitive instruction is how students are guided to achieve the target skill from smaller progressions of sub skills. This learning progression model which was anchored from the work of Popham (2008) as quoted by Arends and Kilcher (2010), shows the iterative process in developing the targeted skill and the role of formative assessments and feedback as an indispensable tool for both cognitive and metacognitive development. The targeted skill is developed in smaller progression or development of the essential sub skills. The development of this skills is deeply rooted in the

interwoven cognitive, in particular, the Chemistry tasks, with the different metacognitive tasks. Ultimately, the students' competence is primarily a function of both their ability to handle Chemistry lessons (cognitive) and planning, monitoring, and evaluating skills through the seven metacognitive activities (metacognitive tasks). The students' exit skills are assessed if the intended learning outcomes are achieved; thus providing feedback to the effectiveness to whole instructional design.
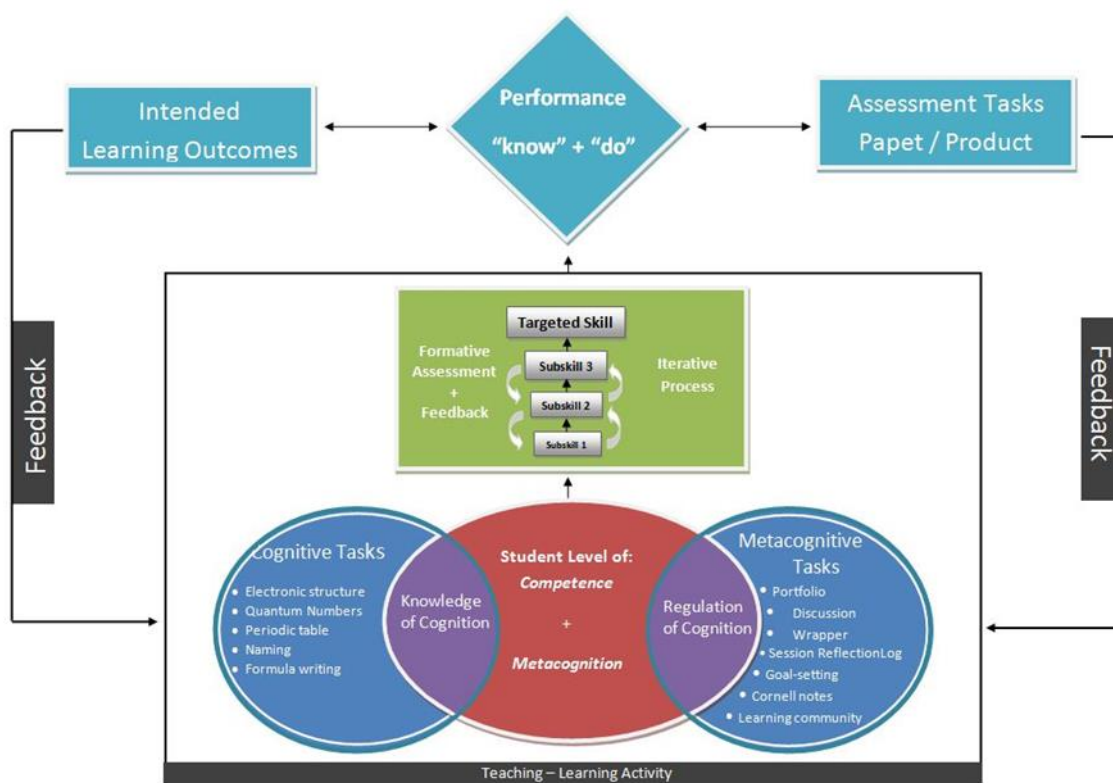

Figure 4. Skill Development with metacognitive Activities

The Metacognitive Activities

This study attempted to find out how classroom processes can be structured so that activities that foster metacognitive awareness can be infused in Chemistry instruction. As suggested by Weisler and Meyer (Cornford, 2002) there are two ways in which metacognition can be taught. First, metacognition can be integrated in our curriculum using adjunct approach in which case, a parallel training to develop metacognition is given to the students outside a certain subject. The second way is through a metacurricular approach. In this case, metacognitive activities that promotes students metacognitive skillfulness is integrated in a specific content subject. The present research undertaking used primarily the metacurricular approach both for practical (adding another mini-class for metacognition would entail time and resources for both the teachers and the students which make it improbable to use with the current school set-up) and pedagogical reasons. These metacognitive activities formed part of what the researcher will term as metacognitive tasks (MT). Rather than an add-on activity, researcher infused the MTs with the Cognitive Tasks (CT) that is, activities inherent to Chemistry. However, an adjunct teaching will be used to make explicit and overt the cognitive and metacognitive strategies which had been taught but embedded in the subject content. Lin (2001) and Cornford (2002) support this holistic approach. They contend that activities should be an integrated, natural part of the learning process rather than an add-on procedure. As commented by Louca (2008) on her review of the works of Vygotsky's Social Cognitive Development: "learning to learn does not happen in a vacuum, it is must be in a context of certain content". This is supported by earlier works in the field of science education that infused metacognitive activities alongside the content (Lovett, 2008). Metacognitive Skills are be developed or learned along with Chemistry topics. To achieve this, the researcher chose seven (7) metacognitive activities intended to foster metacognitive skillfulness among chemistry students. Each of the metacognitive activity is intended to explicitly teach students' metacognitive strategies and collectively to build a classroom culture conducive for metacognitive development. There are seven metacognitive activities that will be utilized in the present research undertaking, viz*: 1) Learning*

Portfolio (LP), 2) Metacognitive Planning/Feedback/Discussion 3) Metacognitive Wrapper, 4) Session Reflection Log, 5) Goal-setting, 6) Metacognitive Note-taking and 7) Learning Community. The activities correspond to specific episodes of the instructional cycles and were tweaked with the intent of purposefully helping students develop metacognitive awareness.

The discussion here is a humble attempt to narrate how these activities were implemented in the chemistry instruction adhering as much as possible to the guidelines set forth at the outset of the study. A short description about the activity as well as snippets of classroom events where these activities were used in the chemistry classrooms are hereby included. Students' brief accounts on these activities are also provided to flesh insights into the students' deeper thoughts regarding the MTs.

Learning Portfolio

Learning portfolio served as a repository of students output. It contained course outline in chemistry, conversion table, periodic table, student individual action plan, reflection log, goal-setting sheets, monitoring chart, student individual performance record (scores on quiz, seatwork, attendance, self-rated oral recitation), and different outputs from chemistry activities. The plan to give the students with a softcopy of an excel files with formula for grade computation for those who wish to make a personal assessment of their grades did not push through. Given the bulk of loads the students have in chemistry and other subjects, the researcher deemed it tedious in the part of the students to still go through the excel-grading activity. Students bring the portfolio every class period since all the materials for purposes already discussed. There were instances when some students forgot to bring their portfolio, they were not reprimanded but they were asked by the teacher to explain their side. Some students found the portfolio heavy and taxing to bring, while others found it useful as a repository of "items" not only in chemistry but also in other subjects. So why would the students bring the portfolio? It was ensured that every class period the materials found in the portfolio were used

in the daily activities; hence; providing a natural motivation to bring it. One of the highlights in this activity was the use of daily class record, specifically, the personal oral recitations. Students were excited to record the rating they gave to themselves. Although, these ratings did not have a bearing on their grades, the researcher believes that it is a form of reflection that is instrumental for adaptive metacognition (Lin, Schwartz, & Hatano, 2005). Since the portfolio provides evidence symptomatic of the students' cognitive and metacognitive developments, it was assessed on the basis of completeness and quality of output. The portfolios were checked three times during the duration of the study. A detailed discussion of some portfolios will be dealt in details during the discussion of sample subject cases.

Metacognitive Planning/Feedback/Discussion

This activity allowed students to engage in the class-wide discussions concerning "understandings" or doubts, queries or problems they encounter as they wade through the different topics in chemistry class. While feedback and whole-class discussion were done in any part of the lesson, it was observed to be strategic at key phases of the instructional cycles. Used during the pre-lesson or lesson introduction, this activity served as a planning scaffolds. It was an important tool in tapping students' prior knowledge. It was also used during the lesson proper as a monitoring tool on learning check points. During the post lesson, this activity was used as "stabilizing" mechanism to galvanize students' understanding of the lesson.

Status of Subjects After Exposure to Metacognitive Activities

Affective Components After Exposure to the Metacognitive Activities

One of the ends of this research is to find out the affective effects of the seven metacognitive activities. Table 6 and 7 reveal the posttest results of the subjects' motivation and scientific attitude, respectively.

Table 6. Post Intervention Motivation Level

Subcomponent	N	Mean	SD	Description	Rank
Intrinsic	42	3.870	0.680	Very High	1
Extrinsic	42	3.7479	0.6199	Very High	2
Relevance to Personal Goals	42	3.6232	0.6026	Very High	**3**
Self-determination	42	3.6006	0.667	Very High	4
Self-efficacy	42	3.5216	0.5669	Very High	5
Anxiety about Science Assessment	42	3.4063	0.4723	Very High	6
Totality	**42**	**3.6283**	**0.601**	**Very High**	

Table 6 shows that the subjects' level of motivation have improved in all subcomponents to be "Very High". Whether there is a significant improvement in the subcomponents or as a whole, it will be determined after the pre-posttest results are contrasted. Meanwhile, the intrinsic motivation still remains to be the top factor for motivation of the students. Although, a marked improvement was seen in both self-determination and anxiety about science, the two subcomponents slid slightly in the ranking. One reason for this is the significant improvements the subcomponents "in relevance to personal goals" and "self-efficacy as will be discussed later."

Scientific Attitude after the Intervention

Table 7. Subjects' Post-Intervention Scientific Attitude Level

Position Statement	Mean	SD	Description	Rank
3AB *To operate in a scientific manner, one must display such traits as intellectual honesty, dependence upon objective observation of natural events, and willingness to alter one's position on the basis of sufficient evidence.*	3.3916	0.3834	Strongly Positive	1
5AB *Progress in science requires public support in this age of science; therefore, the public should be made aware of the nature of science and what it attempts to do. The public can understand science and it ultimately benefits from scientific work.*	3.3518	0.3063	Strongly Positive	2
4AB *Science is an idea-generating activity. It is devoted to providing explanations of natural phenomena. Its value lies in its theoretical aspects.*	3.3292	0.3063	Strongly positive	3
1AB *The laws and/or theories of science are approximations of truth and are subject to change.*	3.3254	0.3789	Strongly Positive	4
6AB *Being a scientist or working in a job requiring scientific knowledge and thinking would be a very interesting and rewarding life's work. I would like to do scientific work.*	3.2873	0.3252	Strongly positive	5
2AB *Observation of natural phenomena and experimentation is the basis of scientific explanation. Science is limited in that it can only answer questions about natural phenomena and sometimes it is not able to do that.*	3.2817	0.3642	Strongly Positive	6
Total	3.3278	0.3906	Strongly Positive	

The post intervention scientific attitude of the students toward science as shown on Table 7, is "Strongly Positive". On average, the subjects' attitude showed a very small increment in the different positions statements. First in the rank is the position statement **3AB** : *To operate in a scientific manner, one must display such traits as intellectual honesty, dependence upon objective observation of natural events, and willingness to alter one's position on the basis of sufficient evidence.* The "Strong Positive" attitude shown by the subjects toward this statement is expected because they have been witnesses to social and technological ramifications breakthroughs bought about by these technological breakthroughs. This could mean too that subjects have high regard to scientists as to the veracity of their claims and confident that the processes are done judiciously. In the contrary **2AB,** tail ended in the spectrum with a mean of 3.2817, although this is still "Strongly Positive" attitude. This could mean that students view science and scientist cannot provide answers to all our questions.

Table 8. Chemistry Performance

Skills	N	Mean	SD	Rank	Description	Rank
Periodic Table	42	4.286	1.785	1	Excellent	1
Electronic Structure	42	3.718	1.270	2	Excellent	2
Formula Writing	42	3.381	1.378	3	Excellent	3
Naming	42	3. 214	1.554	4	Excellent	4
Quantum Numbers	42	1.619	0.936	5	Average	5
Totality	42	3.2476	0.9008		Excellent	

Table 8 shows the subjects Chemistry performance after exposure to the metacognitive activities. It can be gleaned from the table that the overall performance is "Excellent". Their performance is "Excellent", too, in four sub concepts considered, namely, periodic table, electronic structure, and formula writing, and naming of inorganic compounds. However, although there was an improvement in terms of performance, that is, from "Below Average" or "Average to "Excellent", "Poor" to "Average", students level of difficulty in terms of the sub concept considered remain the same. Table 9 shows the comparison of ranking between the pretest and posttest in Chemistry performance. It is very interesting that in this study, the periodic table tops the students' performance, while in earlier research, usually this is considered by many students as the most difficult conceptual hurdle (Gafoor and Shilna, 2013).

Table 9. Subjects' Pretest and Posttest Results in Chemistry

Skills/Concepts	Pretest			Posttest		
	Mean	Description	Rank	Mean	Description	Rank
Periodic Table	2.381	Average	1	4.286	Excellent	1
Electronic Structure	1.833	Average	2	3.718	Excellent	2
Formula Writing	1.405	Below Average	3	3.381	Excellent	3
Naming	1.095	Below Average	4	3. 214	Excellent	4
Quantum Numbers	0.667	Poor	5	1.619	Average	5
Totality	1.4952	Below Average		3.2476	Excellent	

When compared to the work of Gafoor and Shilna (2013), periodic table, followed by chemical bonding, world of carbon was regarded as the most difficult concepts. However, looking into other concepts in their study indicated that in fact, these topics are relatively the most abstract and symbolic in nature compared to topics on mixture and nature of substances considered in their work. In essence the present study and their work draw the parallel experience that the difficulty is also a function of the Chemistry triangle proposed by Johnstone (2000). Maningo (1999) also found out similar observations. Although there were significant improvements in the subjects' performance using limericks, a chemistry-manipulation device, generally, the difficulty according to topics remain the same. However, among the most abstract topics, it is surprising that electronic structure which usually reported to be the most difficult to comprehend because of its very abstract nature, subjects in this research showed to have learned this concept well. When asked for reasons, student appreciated the use of "hotel analogies" used in this study and their personal analogies like *"ang energy levels and orbitals kay mura'g data folders man sab na sya sir. Naa sya's murag sequence-sequence"*. In effect, even the most abstract material can be understood by providing students with opportunity to grasp the concepts using similarities in the actual and more tangible world. The effectiveness of this strategy was also observed in other classroom settings where doing experimentation or physically observing the phenomena is not possible (Ali, 2012). Ali (2012), however, contend that though these models, analogies and imageries may help in the in facilitating learning topics such as atomic models, they may not provide sufficient conditions to help

develop conceptual understating of the topic. It is therefore imperative for teachers emphasize that these symbols, formulae or models are representations of different properties of substance and not a copy of anything (Treagust, Duit & Niewswandt, 2000). Hence, in this research, classroom learning teams and discussions and feedback were used to support this end.

Table 10. Subjects' Post-Intervention Metacognitive Knowledge

Metacognitive Knowledge	N	Mean	SD	Description	Rank
Conditional	42	3.6810	0.5726	Excellent	1
Procedural	42	3.5833	0.5729	Excellent	2
Declarative	42	3.5506	0.4357	Excellent	3
Totality	42	3.6049	0.527	Excellent	

The post-intervention metacognitive knowledge of the subjects is shown on Table 10. On average they have an "Excellent" metacognitive knowledge just like the pretest. Conditional knowledge ranked first with a mean of 3.6 followed by procedural and declarative with means of 3.5833 and 3.5506, respectively. There is a slight increment in the means of the three metacognitive components. This means that the metacognitive activities may have helped in the students' ability to be aware of factors and conditions related to self and the course as they learn Chemistry.

Table 11. Post-Intervention Metacognitive Skillfulness

Metacognitive Knowledge	N	Mean	SD	Description	Rank
Debugging	42	3.8905	0.5963	Excellent	1
Planning	42	3.7449	0.5771	Excellent	2
Evaluation	42	3.5516	3.4747	Excellent	3
Strategy	42	3.4976	0.5771	Excellent	4
Monitoring	42	3.4762	0.4813	Excellent	5
Totality	42	3.6049	0.527	Excellent	

The other component of metacognitive awareness is the metacognitive skillfulness. This component involves planning strategy, monitoring, debugging, and evaluation (Schraw and Dennison, 1994). Table 11 shows that, debugging and planning topped the post-intervention metacognitive skillfulness of the group. It can be gleaned from the table that there were slight increments in all the areas considered. The subjects' average metacognitive skillfulness was "Excellent" after the intervention.

Table 12. Pretest and Posttest Results for Motivation

Sub component	Pre-test		Posttest					
	Mean	SD	Mean	SD	Diff	T-Value	P- Value	Description
Intrinsic	3.862	0.522	3.870	0.680	0.008	0.07	0.945	Not Significant
Extrinsic	3.3524	0.6134	3.7479	0.6199	0.396	3.49	0.001	Significant
Relevance to Personal Goal	3.2714	0.4994	3.6232	0.6026	0.352	3.14	0.003	Significant
Self-determination	3.5238	0.5281	3.6006	0.667	0.77	0.75	0.460	Not Significant
Self-efficacy	3.0333	0.5707	3.5216	0.5669	0.488	3.94	0.000	Significant

Anxiety about Science Assessment	3.0524	0.6310	3.4063	0.4723	0.354	2.96	0.005	Significant
Totality	**3.3492**	**0.5607**	**3.6283**	**0.601**	**0.2791**	**2.39**	**0.000**	**Significant**

* P < 0.05

Table 12 reveals that contrasted pretest and posttest motivational level of the subjects. It can be gleaned from the table that there was an overall significant improvement of the students' motivation when exposed to the different metacognitive activities. Hence, the null hypothesis on this parameter is rejected. Four subcomponents, namely, extrinsic, relevance to personal goals, self-efficacy, and anxiety about science or Chemistry assessment, have shown a significant improvements with P value lesser than 0.05. The other two subcomponents, though, they have shown an increment, did not warrant significant improvement after the exposure. This could be because students have already considered themselves "Highly Motivated" in those areas at the beginning of the study. A closer look and discussion into these components is in place.

Table 13. Pretest and Posttest Results for Scientific Attitude

Position Statements	Pre-test		Posttest					
	Mean	SD	Mean	SD	Diff	T-Value	P- Value	Description
1-AB	3.1984	0.3458	3.3254	0.3789	0.1270	1.86	0.069	Not Significant
2-AB	3.3532	0.4327	3.2817	0.3642	0.0714	0.4100	0.265	Not Significant
3-AB	3.3056	0.5086	3.3916	0.3834	0.0860	0.99	0.326	Not Significant
4-AB	3.1587	0.4131	3.3292	0.3153	0.1705	0.4586	0.021	Significant
5-AB	3.6310	0.6121	3.3518	0.3063	0.2792	3.32	0.002	Significant
6-AB	3.2214	0.5732	3.2873	0.3252	0.0659	0.89	0.380	Not Significant
Totality	**3.3114**	**0.4809**	**3.3278**	**0.3906**	**0.0164**	**1.321**	**0.177**	Not Significant

* P < 0.05

Subjects in the present study; however, tend to disagree with this result. While metacognitive activities made them reflect which is essential in any self-regulating tasks, they suggested that laboratory and relevant hands-on activities may provide opportunities for students to experience how scientists do science. The present study suggests that when instruction is fortified with activities that targets metacognitve skillfulness coupled with laboratory tasks that resemble the works of men of science, then attractiveness of science among our students may render a stronger pull in the hearts of our students.

One interesting question though that lingers is what could account for students significant improvement in position 4A (P value = 0.021) and the significant decline in position statement 5AB (P value = 0.002).

Significant improvement in Students' Attitude with regards to position statement 4AB: Position Statement 4AB

"Science is an idea-generating activity. It is devoted to providing explanations of natural phenomena. Its value lies in its theoretical aspects"

One reason could be that the metacognitive activities did not only allow for a generic reflection of how their thinking processes; it also afforded them thinking processes that are inherent to developing hypothesis and theoretical systems. It is in these theoretical systems that scientists explain the world we live in. As Lawson (1995) puts it: "scientific knowledge is a product of human mental construction…" .This of course necessitates reflective components of self-regulation. Thus when subjects in this research look into where the difficulty lies and what models or diagrams can be made to simplify the

concept they are learning, making sense of the explicit and implied patterns in periodic tables, and in devising better strategy for naming and formula writing; in effect they are exercising the creative and critical thinking process that are required of scientists to explain the different phenomena in nature. This could be the key why students after going through the different activities improved significantly in their appreciation of the theoretical aspects of science.

Observed Decline in Students Attitude with regards to position statement 5AB:

Position Statement 5AB:

"Progress in science requires public support in this age of science; therefore, the public should be made aware of the nature of science and what it attempts to do. The public can understand science and it ultimately benefits from scientific work".

It should be underscored here that science attitude for statement 5AB in posttest mean (M = 3.3518) is still "Strongly Positive" despite the decline. This could be interpreted that in fact students remained strongly supportive on position statements in the questionnaire that include: *"most people can understand science"*, *"people must understand science because it affects their lives"*, *"every citizen should understand science",* and opposed position statements such as*: "only highly trained scientists can understand science", "most people are not able to understand science", "scientific work is useful only to scientists".* The decline could be accounted well when it is viewed from the perspectives of the subjects as consumer of scientific products, that is, knowledge to expound several questions about nature, technology that provides connectivity, comfort or perhaps processes and procedures that saves lives. This seems to be counterintuitive since, these scientific outputs with all its benefits and advantages are supposed to draw science closer to people. However, in the context of the position statement 5AB, one may use any of the aforecited scientific advancement without having to go through the mental rigor associated in discovering them. A student may use an atm machine and appreciates the convenience he enjoys without knowing the actual mechanism that operates it. It is the same with Positron Emission Technology (PET) or Computerized Tomography Scanning (CT-Scan), used in modern hospitals. These technologies allow views on the internal organs for diagnostic and other medical purposes; but patients or medical practitioners would never care the minutiae of these technologies. In the context of the Chemistry lessons, it can be argued that, students after going through the mental processes cited in an earlier discussion in the discussion on "*significant improvement in Students attitude with regards to position statement 4AB*" may have realized that indeed Chemistry, like any other sciences, has its own unique set of requirements in terms of thinking processes and skill that will allow individuals to participate in scientific endeavors. This provides the rationale for the decline observed in the attitudes of the subjects with respect to position statement 5AB.

Contrasting Pretest and Posttest Chemistry Performance

Table 14. Pretest and Posttest Chemistry Performance

	N	Mean	SD	T-Value	P-Value	Description
Pre-Test	42	7.476	3.724			
Post Test	42	16.238	4.504	10.69	0.000	* Significant
Difference		8.762	5.314			

Table 14 and earlier at Table 9, show how the subjects fared in the chemistry performance test in both the pretest and posttest. It can be gleaned from tables that subjects were below average during the pre-test and are excellent during the posttest. At p value =0.000 at .05 significance, there is a significant mean gain in terms of performance. This means that after going through the different metacognitive activities as they learned Chemistry concepts, the subjects have shown a marked improvement in the course. This finding supports earlier claims that metacognition has significant role in teaching and learning Chemistry and other sciences in general (Rickey & Stacy, 2000; Peklaj, 2001; Pulmones, 2007; Lovett 2008, Nbina, J. B., &Viko, B., 2010;Tanner, 2012). Developing metacognitive skillfulness among students could greatly help students learn how to use their content knowledge more appropriately and flexibly Rickey and Stacy (2000). To do this, the use of instructional strategies like the ones used in the present research must be taught alongside the content. These activities may include, concept maps, concept tests, predict-observe-explain tasks (Rickey and Stacy, 2000), metacognitive wrappers (Lovett, 2008). Pulmones (2007), found out that when students were engaged in chemistry activities designed in a metacognitive environment, they had the ample opportunities to demonstrate planning, monitoring, and evaluation skills. These skills, with debugging and use of strategy together

with the different metacognitive knowledge form one's metacognitive awareness. Rahman and Jumani (2010) reported that highly metacognitive aware students performed better on Chemistry tests than their low metacognitively aware counterparts.

In fact even researches in other field draw parallel findings that students who are strongly metacognitive, that is, self-regulated, who excel in planning, managing information, monitoring, debugging and evaluating are more successful

learners (Tok, Ozgan, Dos, 2010; Sawney & Bansal,2015). It is justifiable, therefore, to deduce that the metacognitive activities integrated in the different chemistry lessons drew some positive effects in the students' performance. Thus, the null hypothesis on Chemistry performance as parameter is rejected.

Contrasting Pretest and Posttest Metacognitive Awareness

Table 15. Pretest and Posttest Results for Metacognitive Knowledge

Metacognitive Knowledge	Pre-test		Posttest					
	Mean	SD	Mean	SD	Diff	T-Value	P- Value	Description
Declarative Knowledge	3.4179	0.5832	3.5506	0.4357	0.133	1.20	0.235	Not Significant
Procedural Knowledge	3.4179	0.5668	3.5833	0.5729	0.165	1.43	0.162	Not Significant
Conditional Knowledge	3.4179	0.5668	3.6810	0.5726	0.1961	2.03	0.049	Significant
Totality	**3.4402**	**0.5723**	**3.6049**	**3.4402**	**0.1647**	**1.553**	**0.149**	Not Significant

* P < 0.05

Table 15 shows the pre-post results of the subjects' metacognitive Knowledge. While there is slight improvements in the different subcomponents only the change in conditional knowledge is significant at P value = 0.049. This finding confirms Schunk's (2012) assertions that conditional knowledge is independent from both declarative and procedural knowledge. In the context of the present study, the subjects did not only show some level of mastery of Chemistry concepts, but also the appropriateness of learning strategies called for. Students' reported their thinking process during the interviews: "kung dili me kahibaw kay mu ask me sa amo grupo" [if we don't know we ask help from our group mates] "mag net me sir usually… dugay man gud sa library mas paspas sa net" [we usually surf the

internet… because it's faster using the net than readings books in the library], "Mangutana me sir, sa kung kanus-a gamiton and "ite" "ate" ug "ide" [we ask from the group members when to use the "ite, "ate", and "ide"]; "I think, nindot to nga hotel analogies kay ma visualize nimu ang problem regarding sa atoms" [I think the use of hotel analogy is helpful. You can really visualize the problems on atoms]. In can be noticed that, students' comments draw a parallel skills in the part of debugging which is defined as the students ability to apply strategies used to correct understanding and actions in the process of completing a task. As shown on table 16, debugging as a subcomponent of metacognitive skillfulness marked a significant improvement with a P value of 0.466.

Table 16. Pretest and Posttest Results for Metacognitive Skillfulness

Metacognitive Skillfulness	Pre-test		Posttest					
	Mean	SD	Mean	SD	Diff	T-Value	P- Value	Description
Planning	3.5748	0.5762	3.7449	0.5771	0.1701	1.70	0.096	Not Significant
Strategy	3.4522	0.4776	3.4976	0.5130	0.0454	0.47	0.638	Not Significant
Monitoring	3.4392	0.4775	3.4762	0.4813	0.0370	0.41	0.684	Not Significant
Debugging	3.4961	0.4559	3.8905	0.5963	0.394	3.95	0.000	Significant

Clarivate Analytics **indexed**

Evaluation	3.4747	0.4636	3.5516	0.5341	0.677	0.74	0.466	Not Significant
Totality	**3.6322**	**0.4503**	**3.4874**	**0.4084**	**0.1448**	**1.211**	**0.314**	Not Significant

* P < 0.05

This means that students are able to address questions such as: "I ask others for help when I don't understand something", "Change strategies when I fail to understand", "Re-evaluate my assumptions when I get confused". Apparently, the same questions are addressed while the students are trying to address the conditions upon which they could ensure successful performance in Chemistry class activities. This relationship of the two subcomponent skills lends answer to the significant improvement observed.

On the average; however, both knowledge and regulation of cognition of the subjects did not show any significant improvements after the intervention. Hence, the null hypothesis on this parameter that there is no significant improvement in the metacognitive awareness is hereby accepted. One reason that is at play in this research is the time of exposure. Perhaps when students are exposed to longer period of time then significant improvement may be seen on all the different subcomponents. As Schunk (2012) pointed out, metacognition develops slowly. Teachers may provide longer exposure to students in the different activities. Further, collaboration could be done among faculty members in different subjects where the students are enrolled so there could be a more comprehensive metacognitive exposure beyond Chemistry classrooms. Another interesting angle to

explore is the role of students' belief on one's competence before the actual Chemistry activities than the actual conduct. If it were the case, then this finding lends support to our earlier assumptions that students may have overestimated their abilities at the outset of the study. Earlier work echoes the same observation. While assessing students metacognitive awareness during problem-solving in kinetics and homogeneous design course, Ramirez-Corona, Zaira, López-Malo, & Palau (2013) argued the same reasoning when a subject showed a decrease in its metacognitive awareness score, "we think that he over-assessed its metacognitive awareness in the pre-test and after a whole semester of practicing, recognized its limitations regarding his metacognition skills" (p 9). Students in this situations may have gained a more accurate understanding of themselves, thus, some students may show an increase while others a decrease in the metacognitive awareness scores. Prudence must therefore be taken when conducting researches that rely solely on self-report on metacognition since the subjects may not be able or are not willing to report accurate judgment (Hargrove, 2015).

The Cognitive Effects of Metacognitive Activities

Table 17. Ranking of Metacognitive Activities as to their Effectiveness in promoting Learning

Metacognitive Activities	Frequency	%	Rank
Learning Community	13	30.95	1
Discussion/feedback	10	23.81	2
Learning Portfolio	9	21.42	3
Cornell Notes	6	14.29	4
Goal Setting	2	4.76	5
Wrapper	1	2.38	6.5
Session Reflection Log	1	2.38	6.5
Totality	**42**	**100**	

Table 17 shows the ranking of the different metacognitive activities as to the felt effectiveness by the students. Thirteen or 30.95 % of the total students rated learning teams as the activity that help them learn in the chemistry lessons. Discussion and learning portfolio at rank 2 and 3 respectively. Wrapper and session reflection log tied at the bottom of the rank. The effectiveness of group and collaborative strategies has been explored in earlier works. Johnson and colleagues (2008) as cited by Brame (2015) contend that many instructors use small

groups or peer-to-peer instruction to promote students working together to maximize their own and each other's learning. The purpose could vary from increasing student understanding of content, to build particular transferable skills, or some combination of the two. In other words, when the class of 42 students was divided into mini-chemistry classes everyone was given the chance to participate. An opportunity which is often times not afforded to all due to class size and instructional time constraints. Further, students who

engage in this "microcosmic" class are given the chance to see an academic task in varied perspectives.

The Affective Effects of Metacognitive Activities
Students' Motivation

Table 18. Ranking of Metacognitive Activities as to their effectiveness in making students become more motivated in chemistry class.

Metacognitive Activities	Frequency	%	Rank
Learning Community	17	40.48	1
Discussion	11	26.19	2
Cornell Notes	9	21.43	3
Wrapper	2	4.76	4.5
Goal Setting	2	4.76	4.5
Learning Portfolio	1	2.38	6
Session Reflection Log	0	0	7
Totality	**42**	**100**	

Table 18 reveals that subjects regarded learning community as the metacognitive activity that made them feel motivated in chemistry class. There were 17 (40.48%) of the participants that ranked it first. It was followed by discussion/feedback which was chosen by 11 students (26.19%) and Cornell notes with nine (21.43%) students. Wrapping and goal setting are tied at ranked 4.5 with both chosen by two (4.76%) students. Meanwhile learning portfolio and session reflection log were posted at the bottom of the rank. The context of the ranking can be understood fully by listening to the voices of the students themselves.

Students' Scientific Attitude

Table 19. Ranking of Metacognitive Activities in terms of effectiveness in making students feel like a scientist while in Chemistry 1 class.

Metacognitive Activities	Frequency	%	Rank
Discussion/Feedback	15	35.71	1
Goal Setting	7	16.67	2.5
Learning Community	7	16.67	2.5
Cornell Notes	6	14.29	4
Learning Portfolio	4	9.52	5
Wrapper	3	7.14	6
Session Reflection Log	0	0	7
Totality	**42**	**100**	

Many students believe that science and chemistry in particular are essential for the societal advancement. However, as tackled earlier, students perceive science as a difficult subject removed from reality, and less fun. These reasons promoted researches like the current undertaking to peruse into the students personal point of view on the instructional provisions in science classrooms. What activities, materials, and instructional set-up may be given to augment students' positive outlook regarding science? On table 19 it can be gleaned that discussion/ feedback and learning community and goal-setting are the top meta-activities that students felt strongly about that help them "feel" like a scientist. There are two major things that have to be addressed here. First, what do we mean by "feel like a scientist" or have the students felt like one? Second, what are the common things about these three activities that when used as an instructional strategy, students had that "sense" of being a scientist. To answer these queries, students' exit interviews provide a glimpse of the subjects' thoughts on the matter. The table that follows shows a summary of the students responses when they were asked "about feeling" like a scientist. For students who responded negatively, believed that laboratory takes at the centerpiece of chemistry instruction. They contend that actual manipulations of chemicals and apparatuses would lend those experiences akin to scientific endeavors. In contrast, there were students who upon recognition at the outset that chemistry 1 course is only lecture made use of instructional provisions like, reflection, summarizing, inferring, and even simple and mental manipulations like naming, formula writing, predicting patterns in

periodic table, and quantum number computations which has an effect as what "laboratory" can do. Therefore, feedback-discussion, learning community, and goal-settings are perfect avenues for students to explore these activities that provided the necessary engagements usually afforded by laboratory activities. This finding confirms earlier works that metacognition plays a key role in teaching in the theoretical framework of Teaching Science as Inquiry (Seraphin, Philippoff, ,Kaupp, &Vallin, 2012).This does not mean however that these activities may substitute the laboratory. Because while metacognition compliments with inquiry and other methods of teaching science, through regulation of their own learning and consequently do appropriate adjustments, students may still feel deprived of authentic science experiences deemed to promote positive attitude toward science among students.

Conclusion

In the light of the findings and the foregoing interpretation made, it was concluded that metacognitive activities integrated in the different learning episodes of Chemistry instruction rendered positive effects to the subjects' cognition, and affect to some extent. Specifically, the intervention scheme drew improvements in the subjects' chemistry performance and motivation.

Recommendations

With the validation of the points raised in this study and upon presentation of its output, the following recommendations are made:

1. Since in the present study, the subjects were exposed only to three-month intervention, a prolonged exposure to metacognitive environment is worth exploring. Further, ample time may be allocated for students to interact in groups. This could be done with some tasks at hand which will serve as a fulcrum so that discussion will not veer from the learning intent.

2. Topics which are abstract in nature may be taught using some activities that will relate to the tangible and macroscopic world. Analogy and activities with chips, and manipulative devices may be used. Further, Hands-on activities that provide rich opportunity for students to have a glimpse of the world of scientists are suggested to be in place.

3. Science courses such as chemistry are suggested to be taught with laboratory following the teaching science inquiry philosophy.

4. Since goals whether long term just like finishing the degree or short-term like passing a term or the course has an impact on how students will likely perform in the class, course and class advisers are encouraged to let their students write their goal statements. Hence; schools may develop advisory system or career-guidance program whether in the institution or college levels.

5. Schools could provide ample and varied opportunities for students to succeed and move up in the academic rung. Schools can design online or semi-online platform to cater to working students, second coursers, and working professionals whose circumstance could hamper in their maximum compliance and access to classroom activities.

6. For the curriculum framers, courses such as Environmental Science, Science Technology and Society may be offered in lieu of lecture classes on Chemistry or Physics in the curriculum of non-science majors so that relevance to students' personal lives and career may be achieved.

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AN ANALYSIS OF BRINES FOR CHROMIUM CONTENT BY SPECTROPHOTOMETRIC METHOD USING CO-PRECIPITATION CONCENTRATION

Abstract: *Coprecipitation of chromium on magnesium hydroxide was studied. Coprecipitation mechanism was proposed. The use of high-frequency ultrasound (US) and simultaneous action of ultrahigh-frequency and low-frequency US for intensification of chromium coprecipitation was investigated. It has been found that dispersing and mixing effects are the determining factors of the US action on co-precipitation concentration. The method of spectrophotometric determination of chromium in brines has been developed. The content of chromium in the natural brines of Ukraine was determined. It was shown that the use of double-frequent US allows us to increase the degree of chromium determination from 92-93% up to 96-98% and also to improve metrological characteristics.*

Key words: *Chromium, brines, ultrasound, coprecipitation, spectrophotometry, metrologic characteristics.*
Language: *English*
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Soi: http://s-o-i.org/1.1/TAS-03-95-2   *Doi*: crossref https://dx.doi.org/10.15863/TAS.2021.03.95.2
Scopus ASCC: 1600.

Introduction

Chromium is toxic trace elements having cancerogenic effects. Its content is regulated in drinking water and food products [1,p.24; 2,p.662; 3,p.124], the maximum possible content of chromium is 0.1-0.5 mg/dm^3. Brines are a raw material for production of various types of kitchen salt [4,p.158;5,p.576;6,p.763;7,p.45]. The content of

chromium in kitchen salt should not be more than 0.1 mg/kg. However, the presence of chromium in natural brines leads to its appearance in kitchen salt [8,p.247;9,p.37;10,p.11]. We have previously developed the methodic for electrothermal atomic absorption determination of chromium in brines and kitchen salt. But not all laboratories have atomic absorption spectrometers. Therefore, it became necessary to develop the methodics of spectrophotometric determination of chromium in brines. Direct spectrophotometric determination is not possible due to significant matrix effects and insufficient sensitivity. Therefore, it is necessary to use preconcentration by co-precipitation, which is practically independent of the mineralization of the solution and does not require the use of toxic substances.

The purpose of this work is to develop an environmentally safe methodics for spectrophotometric determination of chromium in brines using coprecipitation concentration with improved metrological characteristics.

Experimental

We used spectrophotometer SF-46, electronic scales OHAUS PA 64 (65/0.0001 g), ultrasound disperser UZDN, centrifuge T23, measuring laboratory flacks, according to DSTU 1770-74, electron ionomer Rn-673, bidistilled water.

To prepare standard chromium solutions, standard samples of composition of MSO solutions with a chromium concentration of 1 mg/l were used. Sodium chloride, phr., was further purified by recrystallization. HCl, phr., was further purified by isopiotic distillation.

A sample of kitchen salt with mass of 2.00 g is dissolved in 10 cm^3 of bidistilated water, added with 0.05 cm^3 of hydrochloric acid (1:1) and 10 cm^3 of mixture of acetylacetone and chloroform (1:1), the mixture was shaken for 1 min, organic phase was separated. The water was transferred to a tube, pH was raised up to 6 with ammonia, and 10 cm^3 of acetylacetone was added. The tube was placed in a magnetostrictive radiator and affected by a 44 kHz US system with an intensity of 2 W/cm^2 for 20 seconds. Then 0.5 cm^3 of hydrochloric acid, 10 cm^3 of acetylacetone were added to the tube and shaken for 1 minute. Chromium (III) detection limit - 0.01 mg/kg. For analysis, 10 g of brine with a sodium chloride content of not more than 200 g/cm^3 was taken and brine was diluted with bydistillated water. 2 g of kitchen salt was dissolved in 10 cm^3 of bidistylated water, 0.5 cm^3 of hydrogen peroxide, was treated by ultrasound with frequency of 44 kHz, intensity of 2.0 W/cm^2 for 1 min. Then content of total chromium was determine.

Results and discussions

Figure 1 shows the dependence of the degree of destruction of organic compounds in the natural brines of the Geroyskoye source on the frequency of the US at the maximal possible intensity for modern piezoceramic emitters - 12 W/cm^2. From the experimental data, presented in Figure 1, it ca be seen that with an increase in the frequency of US, the degree of chromium destruction decreases significantly. The decrease in the degree of ROP destruction is obviously explained by the fact that with an increase in the frequency of the US, an increase in the intensity of the US is also necessary to raise to the corresponding level of cavitation activity. It should also be noted that for solutions of kitchen salt and sea water, the similar dependencies of ROP destruction degree on the frequency of MW were obtained.

However, as the content of organic substances (humic and fulvic acids) in brine samples and sea water decreased, the dependence on frequency is less important; that can be explained by the fact that with a lower content of organic substances, a lower level of cavitation activity is needed for their destruction, which depends on the frequency of the US.

Figure 2 shows the dependence of degree of destruction of organic chromium compounds in brines on the intensity of US at its frequency of 400 kHz and the action time of 2 minutes. As follows from Figure 2, with the increase in US intensity, the degree of destruction of organic chromium compounds increases.

The effect of the time of US action on the degree of RUR destruction at different US frequencies was also investigated, while the intensity of the US was maximal possible - 12 W/cm^2. As follows from the results of the experiments given in Fig. 2, in order to achieve the ROP destruction rate 90%, the time of US action should be the longer the higher US frequency, since with an increase in the US frequency, it is necessary to raise the corresponding level of cavitation activity and increase the US intensity, which is limited by the mechanical strength of the piezoelectric power of US intensity not more than 12 W/cm2. From the results of experiments, it also follows that it is possible to use ROP for destruction in brines of US action with frequency up to 200, 250 and 600 kHz, respectively, when the ROP distruction time increases up to 10 min [11,p.34].

However, with an increase of time of action of the US, the metrological characteristics of the Chromium determination results deteriorated in all samples. Moreover, with an increase in the frequency of US, for the destruction of organic compounds, a large intensity or duration of the US action was required. In the analyzed samples, characterized by a large content of organic substances, with an increase in the frequency of US, a significant deterioration in the metrological characteristics of the obtained results was observed. Therefore, the satisfactory metrological

characteristics of the Chromium determination results in salt brines and solutions of kitchen salt were obtained with use of US with a frequency of up to 100 kHz. At the same time, compared with use of previously studied low-frequency range of US, the results of analysis, obtained using medium-frequency UZ had better reproducibility. It may be explained by higher level of stability of piezoelectric emitters operation compared to magnetostrictive ones [12,p.45].

Thus, for the destruction of organic substances in brains, US can be used in the frequency range from 18 to 100 kHz, and in sea water - from 18 to 200 kHz; the results can be obtained in the frequency range of 80-100 kHz, respectively.

The two types of bubbles are formed in the cavitation field: large deformed bubbles (VDB), which cause physicochemical effects: surface cleaning, mass exchange, erosion and small spherical bubbles (GSB), during the splitting of which sound chemical reactions and sonoluminescence occur. When using the combined action of high (1 MHz) and low frequencies (18-47 kHz), the total mass of the GSB prevails over the total mass of the airborne bombs. In this regard, the use of compatible high and low frequency SLM for the destruction of organic compounds in salt solutions and brines has been studied. In this case, laboratory equipment was used, the same as in the study of the combined action of high and low frequencies in sonoluminescent spectroscopy.

The change in frequency of the low-frequency US from 18 up to 47 kHz by the value of the degree of ROP destruction in the brines was not affected, a comparison of the obtained results using high-frequency US with a frequency of 1 or 2 MHz show us that the best results were obtained in the first case (Table 2).

The optimal intensity of the high-frequency US and the low-frequency US depends on their relation, the type of the analyzed product and frequency of high-frequency US (Table 1). In this case, the optimal intensity is an intensity that ensured the achievement of the maximum possible degree of destruction of organic compounds. It should be noted that the optimum intensity when using only one low-frequency US that is significantly higher and ranged from 7.0 to 10 W/cm^2 [13,p.67; 14,p.77; 15,p.17].

The action time of the two frequency US should be not less than 0.5 minutes for sea and river water, and not less than 1.0 minutes for brines of Ukrainian sources, and for brines of Lake Jaksa-Archaeologist (Kazakhstan) - 2 minutes, since the last source is characterized by abnormally high content of organic substances (Table 3). It should also be noted that even with a 3 times increase in time of US action, the degree of destruction of organic compounds does not changes. The order of switching on low and high frequency US did not affects the results.

The proposed method provides the obtained results of analysis with better metrological characteristics than standard method, based on destruction of organic compounds in salt solutions and brines. An improvement of metrological characteristics is explained by the higher stability of ultrasonic emitters at low US intensities.

The most expressive method is the method based on the use of low-frequency US (10 W/cm^2) and the method based on the use of low-frequency US with hydrogen peroxide addition, but the last method is hindered by the need to introduce additional reagents. The maximal possible degree of ROP destruction is provided by the method, based on the use of medium frequency UZ (80-100 kHz) and the method based on the use of simultaneous action of high and low frequency US. The first method does not require complex design and provides results with better metrological characteristics, and the second is more expressive.

Conclusions

1. Coprecipitation of chromium on magnesium hydroxide was studied. It has been shown that at optimal conditions degree of coprecipitation does not exceed 93%, respectively. To increase degree of coprecipitation, it is recommended to use US action.

2. We studied the use of US in determining chromium in brines: how to transfer chromium compounds to the forms undergoing, coprecipitation, as well as how to intensify concentration by coprecipitation on magnesium hydroxide.

3. A project of an express method for determining chromium in brines has been developed, including ROP destruction, coprecipitation of chromium on magnesium hydroxide with US process intensification. In the resulting chromium concentrate, the SF was determined by the diffenylcarbazide method at 535 nm. Lower limit of chromium detection in brines id 0.001 mg/kg, relative standard deviation of analysis results does not exceed 0.08.
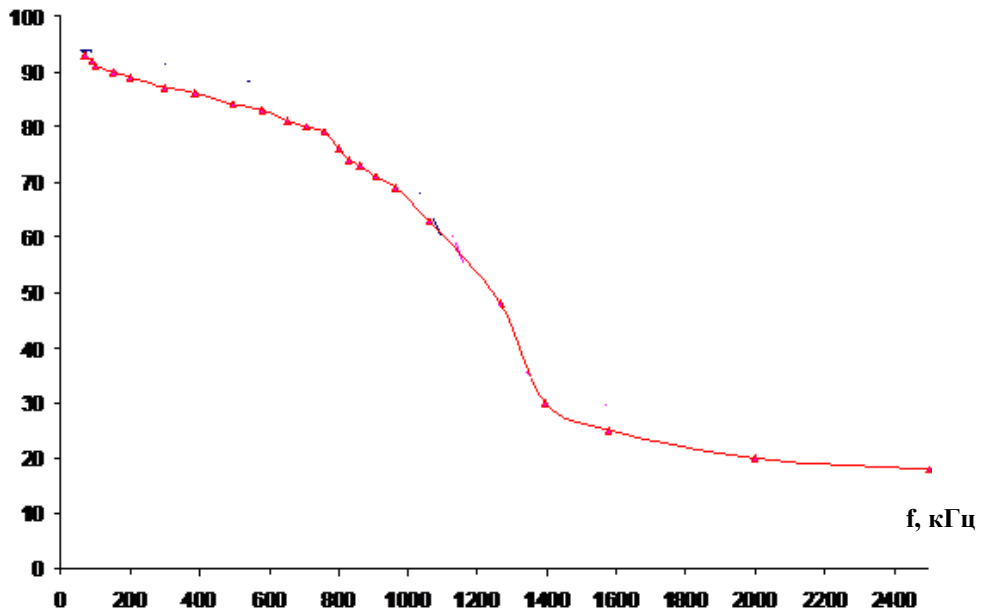
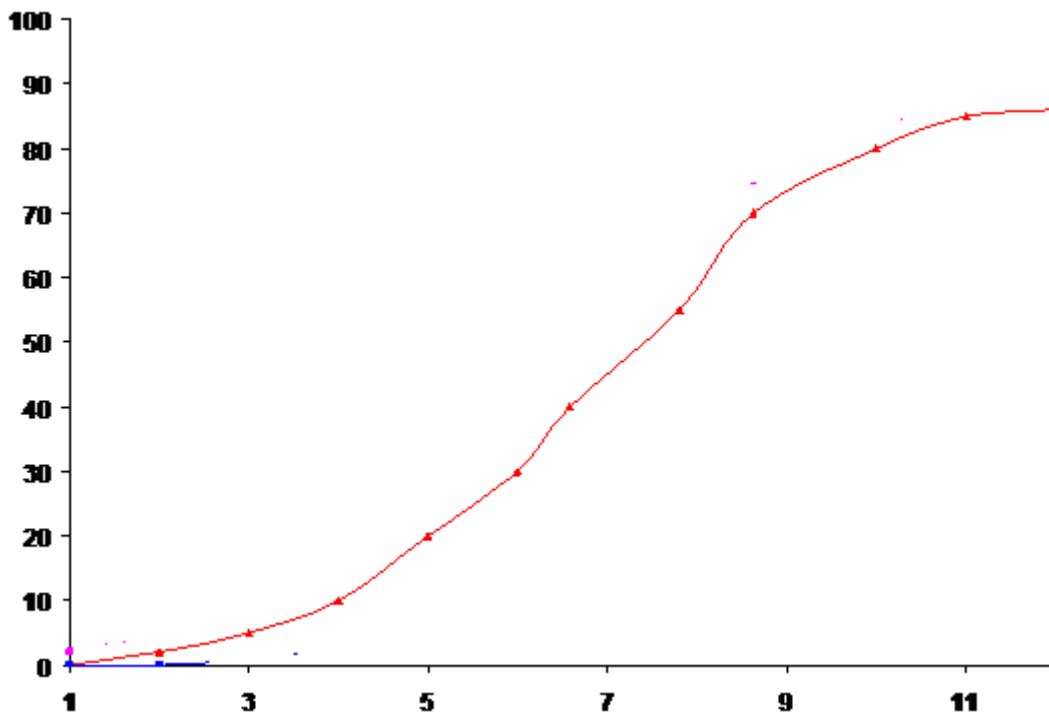**Fig.1 Ultrasound frequency dependence on the degree of destruction of organic compounds in the natural brines**

Fig.2 Ultrasound intensity dependence on the degree of destruction of organic compounds in the natural brines

Table 1. Ultrasound frequency influence on the degree of destruction of Chromine ROP

Sample	The degree of destruction of organic compounds %	
	1 Mhz	*2 Mhz*
Brine from Sloviansk factory	99	98
Brine from Bascunchak lake, Russia	99	96
Brine from Barsa-Kelmez lake, Kazahstan	99	96
Brine from Henichesk factory	97	97
Sea water, Yalta village	99	97
River water, Bahmut river.	99	96

Table 2. Ultrasound intensity influence on the degree of destruction of organic compounds in the natural brines

US intensity, W/sm^2	degree of destruction of organic compounds % at US intensity, W/sm^2					
	1	*2*	*3*	*4*	*5*	*6*
Brine from Heroiske factory						
1	45	61	74	86	90	96
2	93	98	97	99	98	99
3	93	96	98	99	99	99
4	943	97	98	99	99	99
Brine from Sloviansk factory						
1	66	67	72	83	87	92
2	97	98	98	99	98	99
3	98	99	98	99	99	99
4	98	99	98	99	99	99
Brine from Barsa-Kelmez lake, Kazahstan						
1	47	57	65	743	75	80
2	90	93	98	98	98	99
3	93	96	98	99	99	99
4	96	976	98	99	99	99

Table 3. Ultrasound time influence on the degree of destruction of ROP

Sample	US time, min.	The degree of destruction of ROP, %
Brine from Sloviansk factory	0,5	94
	1,0	98
	2,0	99
	3,0	99
	4,0	99
Brine from Barsa-Kelmez lake, Kazahstan	0,5	83
	1,0	87
	2,0	98
	3,0	98
	4,0	99

Table 4. The results of chromine determination (n=5; p=0,95)

Sample	Found out, mg/kg
Brine from Sloviansk factory	0,033/0,092
Brine from Barsa-Kelmez lake, Kazahstan	0,543/0,092
Without organic compounds destruction	
Brine from Sloviansk factory	-
Brine from Barsa-Kelmez lake, Kazahstan	0,220/0,060

Table 5. Comparative characteristic of destruction methods of ROP in brines (n=5; p=0,95)

Factor	Factors value
Destruction of ROP by the standard method– US of 22 кHz frequency	
Optimal US intensity	10 W/sm^2
Time of the process	0,3–0,5 min.
Standard deviation	0,070–0,087
Destruction of ROP by the method– with 100 кHz US frequency	
Optimal US intensity	12 W/sm^2
Time of the process	2–4 min.
Standard deviation	0,062–0,071

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DEVELOPMENT OF THE FOUNDATIONS OF INTEGRATED METHODS OF TEACHING THEORETICAL KNOWLEDGE IN THE DISTANCE EDUCATION SYSTEM USING INFORMATION TECHNOLOGY

Abstract: This article highlights the issues of studying and mastering the complex theoretical foundations of special subjects for students and undergraduates of higher educational institutions. At the same time, a wide application of the information technology system is proposed and a scheme for studying and mastering the theoretical foundations of special subjects in distance learning has been developed.

Key words: Master, student, integral methods, deterministic, stochastic communication, road transport, reliability theory, distance learning, information technology.

Language: English

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Introduction

It is known that obtaining knowledge with theoretical features has certain difficulties and requires serious work from the student. Since theoretical knowledge is outside our field of vision, we have very little chance of mastering it by sight. Such knowledge is mainly acquired through independent and mental thinking. Consequently, such knowledge depends on the student's ability to think, visualize material using spatial thinking, have

sufficient knowledge of related disciplines and other similar characteristics of perception. The higher a student's thinking ability, the higher his or her chances of learning. But in general, with the exception of most students, they acquire analytical knowledge with a number of difficulties. To facilitate the development of complex theoretical knowledge by students and masters in the educational process of universities, along with traditional methods of teaching academic disciplines, new information technologies are

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increasingly used, which contributes to a change in the very method of presenting material. The use of computer technologies (CT) in the learning process increases the quality of assimilation and educational information, makes the process of their learning more effective and productive, provides an increase in motivation to gain knowledge of a theoretical and practical nature [1,2].

The practice of using computers initiates the emergence of a new generation of CT, which, in turn, makes it possible to improve the quality of education, create new means of educational influence, effectively interact with computers, and develop the information competence of teachers and students. The introduction of CT in education can be seen as the beginning of a revolutionary transformation of traditional teaching methods and technologies and the entire education sector. Communication technologies play an important role at this stage: telephone means of communication, television, which are mainly used in managing the learning process in distance learning systems.

An example of the successful implementation of CT in modern educational institutions is the introduction of the Internet into universities with its practically unlimited possibilities for collecting and storing information, transmitting it to each user [4].

Orientation to innovative technologies in the field of education, modern material and technical base, highly professional teaching staff - everything in a large educational, scientific and innovative complex of the country is aimed at producing competent specialists who are well-trained to create high-quality products, thinking progressively and creatively solving the assigned tasks ... The main educational value of information technology is that it allows you to create a brighter interactive learning environment with unlimited opportunities available to both teachers and students. The advantages of information computer technologies in comparison with traditional ones are manifold. In addition to the possibility of a more illustrative, visual presentation of the material, effective verification of knowledge and everything else, they include the variety of organizational forms in the work of students, methodological techniques in the work of a teacher. In contrast to conventional technical teaching aids, information technology allows not only to saturate the student with a large amount of knowledge, but also to develop intellectual, creative abilities, their ability to independently acquire new knowledge, to work with various sources of information [2].

II. METHOD OF EXPERIMENT

At the same time, the basic information about theoretical knowledge to students is first of all provided by the teacher during the lecture, and then this knowledge is supplemented with the help of practical exercises. However, even the knowledge gained in these classes is still insufficient. In order to fully master the theoretical knowledge in the chosen subject, the student must be able to work independently, develop practical skills based on the knowledge gained, have excellent knowledge of the use of CT in the educational process, and also be able to express their personal opinions and suggestions. One of the most important conditions for meeting these requirements is the student's interest in the subject being studied. To implement these requirements, students are offered the following integrated schematic methods that facilitate the acquisition of theoretical knowledge and help applicants acquire knowledge in developing memorization skills and applying them in practice for a long time.

For example, the following theoretical material is given: "Foundations of the theory of reliability of road transport. Failure is a random event, a study of its current distribution laws. "The solution of these problems is based on the knowledge of probability theory, statistical mathematics, physics, road transport and its technical operation, as well as other similar disciplines and has a high complexity. Therefore, it is desirable that the first information about the theory of reliability is explained by the teacher during lectures in connection with the provisions of applied, statistical mathematics and information technology systems.

In modern conditions, the importance of applied mathematics is invaluable, with the help of which it is possible to predict random events in various areas of technical and economic sectors and find the optimal ones, i.e. the most profitable technical and economic solutions based on an information technology system without high costs. If we consider each case as an event, its occurrence depends on several arguments and forms a mathematical relationship between the event and the arguments, and this relationship is divided into two types [3]:
- deterministic communication;
- stochastic connection.

Deterministic relationships are based on known patterns, and such related events occur on the basis of these patterns. In a deterministic relationship, the value of each argument corresponds to one function value. An example of a deterministic relationship is a freely falling object. In this case, each value of the path traversed by the object corresponds to a certain value of time. The path traversed by a freely falling body is determined by this well-known equation.

$$S = \frac{gt^2}{2}$$

Stochastic relationship is a relationship in which each value of the argument has a different value of the distribution density of functions. Stochastic relationships are presented using mathematical models, and in many cases, rough conclusions are drawn about the relationships considered using these models. Mathematical models are used in various

fields and sectors of the economy. For example, in engineering, biology, chemistry, medicine, economics and so on. Mathematical models allow expressing the essence of the process under consideration using a mathematical model and choosing optimal solutions for it. In order to objectively (clearly) express the patterns of the processes under consideration, mathematical models must take into account all internal and external factors influencing this process. To achieve this state, it is necessary to plan an experiment on the process, conduct it, statistically process and analyze the results using computer technology.

All aspects of human activity can be expressed using mathematical models, and all internal and external factors affecting each process under consideration are random. And the influence of these random factors on the process is of a guided nature.

For example, the efficient operation of a service station (STO) is inextricably linked with the accidental entry of cars into the station, their presence at it, as well as the random time spent on maintenance (MOT) and car repairs. It also depends on the random arrival time of the customer at the dealership and the random customer service time. In such conditions, that is, under the influence of several random factors per process, it will be necessary to find optimal solutions for a number of indicators, such as equipment, number of workers, working capacity, quality of repair, and so on.

Thus, the relationship between all the processes under consideration and the factors that randomly affect them, and the identification of the mathematical expression of these laws, the search for optimal (most convenient) solutions and the correct organization of the experiment can be carried out only with the help of probability theory, statistical mathematics and information technology.

The mathematical theory of reliability is important in solving all problems of vehicle maintenance and repair. In particular, the issues of improving the quality of products manufactured in the automotive industry are absolutely impossible without the theory of reliability. Because the main components of reliability indicators are:
• reliability;
• durability;
• maintainability;
• preservation.

The numerical values of such classifications are determined based on the theory of reliability. This theory serves to study the regularities of the causes of defects in products, to determine the wear time of the product and to develop measures to improve its reliability. Any product manufactured in mechanical engineering must have high performance based on experimental tests. The results of such an experiment are statistically analyzed and the following random phenomena are studied:

• random phenomena;
• random variables;
• random processes.

Random processes are such a connection that it either happens or does not happen. For example, the transmission of a car may or may not work for 400-500 hours of operation. This means that transmission failure at regular intervals is a random event. The probability of propagation of random events is expressed by R (L), and the density - R (L). The probability of an event occurring is determined prior to experimental testing and, under normal conditions, is expressed as follows:

$$P(L) = \frac{m(L)}{n}$$

m (L) – the number of favorable conditions for the event;

n – is the total number of possibilities.

The distribution density of random events is determined from the results of experimental tests, i.e.:

$$R(L) = \frac{m * (L)}{N}$$

m * (L) – the number of occurrences of a random event;

N is the total number of experiments performed.

Random values are numerical values that can be the result of an experiment and have any previously unknown values. For example, the distance traveled by a car's braking system to failure is a random variable. The laws of analytical distribution of random variables are usually written in the following form:

$$Y = f (x)$$

x – value of a random variable (argument);

Y – distribution density (function).

A random process is defined as a function that, as a result of experiments, takes on a random form that was not previously known. Acceptance of a random function of a specific random form is also its implementation.

For example, abrasion of cylinder liners, piston rings, liners and bearings of an automobile engine. There are the following main types of wear of engine parts: abrasion and scuffing of rubbing surfaces, which can be mechanical, corrosive and abrasive, The nature, reasons for the appearance, quantitative assessment and determination of patterns that describe the essence of the flow of such types of wear are also revealed by probabilistic methods of the theory of probability and mathematical statistics [five]. Under normal operating conditions, it is the abrasion of the parts that determines the life of the engine.

As mentioned above, random variables are represented by the laws of probability and correspond to the physical nature of the considered random events. Probability laws can be one-dimensional or multi-dimensional.

The numerical values of the reliability indicators in the operating conditions of the car and its components are determined using the laws of random events, which are based on:

The density of the function of the law of normal distribution is determined by the following expression:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} exp\left[-\frac{(x-\overline{x})^2}{2\sigma^2}\right]$$

f (x) – distribution density of the law;

x – is a random variable;

$\overline{x}$ – mean mathematical value of a random variable;

σ – standard deviation σ = 2.72

While the normal distribution law is a process of gradual wear of automobile parts, the mathematical model of the exponential distribution law represents the state of failure in the theory of reliability. Such pressure failures occur during overload and heat stress, for example, failure of engine parts at engine temperatures above 100 ° C, lamp burning in case of overvoltage, etc.

The exponential distribution reflects the processes of replacing broken parts, lubricating, adjusting engine components and other similar maintenance operations for cars at service stations.

The laws of exponential distribution also play an important role in the theory of reliability and are used to determine the numerical values of vehicle reliability indicators.

The distribution density of the exponential distribution law is expressed by this formula.

$$F(t) = e^{-\omega t}$$

Where:

T – is a random variable, time or distance traveled by the vehicle (hour, day, month, year or m, km);

ω – parameter of the regularity or density of its distribution;

e – random event per unit of time, failure / hour., refusal/km.

In addition to these laws, there are a number of laws in the field of car operation, including: Poisson distribution law, Weibul distribution law, gamma distribution law and others.

III. EXPERIMENTAL RESULTS

To master the above material, a master student or student must solve examples and problems in practical classes and work on himself independently. In addition, the student summarizes his opinions about the assimilated material of analysis and places them in the integrated circuit shown in the picture 1.

IV. CONCLUSIONS

1. When analyzing the coverage of the issues of studying and mastering the complex theoretical foundations of special subjects for students and undergraduates of higher educational institutions in distance learning, it was determined that the relationship between all the considered processes and factors that influence them randomly, and the identification of the mathematical expression of these laws, the search for optimal (the most convenient) solutions and the correct organization of the experiment can only be carried out with the help of probability theory, statistical mathematics and information technology.

2. An integrated circuit for the study of complex theoretical knowledge has been developed, in which a student or master's degree student summarizes and places his views on the material learned and analysis.

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┌──────────────────────────────────────────────────┐
│  Mathematical foundations of the theory of         │
│                reliability                          │
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┌──────────────────────────────────────────────────┐
│     Random events, quantities and processes        │
└──────────────────────────────────────────────────┘
           │                              │
           ▼                              ▼
┌──────────────────────┐      ┌──────────────────────┐
│   Probability theory  │      │   Probability theory  │
└──────────────────────┘      └──────────────────────┘
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│  Relationship between random events and arguments   │
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┌──────────────────────┐      ┌──────────────────────┐
│ Events with specific  │      │ Previously unknown    │
│         laws          │      │        events         │
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┌──────────────────────┐      ┌──────────────────────┐
│ Various physical laws │      │  Mathematical models  │
└──────────────────────┘      └──────────────────────┘
           │                              │
           ▼                              ▼
          ┌──────────────────────────────────┐
          │    Representation of laws (model)  │
          └──────────────────────────────────┘
           │                              │
           ▼                              ▼
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$$S = \frac{gt^2}{2},\ I = \frac{U}{R},\ s = vt\ and\ other$$

Normal, Exponential, Weibul, Poisson and others

Working areas

Some physical phenomena

The image of various vital and production functional phenomena, etc.

Personal opinion of the student, suggestions

Picture1. Integrated circuit for studying complex theoretical knowledge

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MODELING OF THE COKING PROCESS

Abstract: The article is devoted to the modeling of coking as the most common conversion process of vacuum residue in oil refineries. The main parameters of the process and the impact of the products on the product and characteristics are taken into account. The main features of each process (chemistry, kinetics and thermal decomposition of asphalts) are summarized. Some dependencies published in the literature are evaluated and used to predict the yield and properties of coke products.
Key words: Coking process, kinetic parameters, oil, atmospheric residue, resin, asphalten.
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Scopus ASCC: 1106.

Introduction

At present, the gradual coking of all technologies for the processing of heavy crude oil with the depletion of carbon has a special place, because it is very economically viable for refineries. The purpose of coking is to convert residual raw materials (residues of oil distillation in the atmosphere and vacuum column) into lighter and more valuable products, including gases, gasoline fractions, light and heavy gas oil, as well as solid products - petroleum coke. During coking, long hydrocarbon molecules break down into shorter ones under thermal conditions.

This process is called "gradual coking" because the cracking reaction takes place in the coking chambers, where the heated raw material has a longer shelf life, rather than in the kiln's snake tubes. Failure to do so may result in coking of the pipes and premature shutdown of the unit. The heat given off by the kiln to the raw material is sufficient for destructive distillation, but without the raw material entering the coke chamber, the coke is not delivered to initiate recovery reactions. In other words, heating in the furnace only initiates cracking reactions, which are completed in the coking chambers [1-4].

Method

Oil refineries with coking facilities are often referred to as continuous refineries. The advantage of coking is the inherent flexibility of the conversion process of various raw materials, which allows to solve the problem of reducing the demand for heavy oil by switching to the production of more expensive and lighter products.

One of the goals of the coking process may be the production of different types of coke. Coking can produce several types of coke, depending on the characteristics of the raw material, the design of the plant and the operating conditions [2]. Fuel coke, anode coke, needle coke.

By changing the operating parameters, it is possible to change the quality and productivity of coke products in accordance with the goals set by the refinery. The variable parameters in the coking plant are:

- Heat when leaving the furnace and at the entrance to the coking chambers. Heat is the main parameter that determines the coking conditions. Heat determines the quality of coke;

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- Pressure in the coking chamber. The coking output decreases with decreasing pressure in the coking chambers;

-Recycling ratio of raw materials;

- composition of raw materials;

Results
Kinetics of coking reactions

The kinetic parameters of coking and pyrolysis reactions can be determined by conducting TGA at different temperatures. Based on isoconversion methods, Schuker (1983) obtained a number of activation energies for pyrolysis depending on the evaporated part of the asphalt. At higher conversion rates, the activation energy was higher. On the other hand, Shikh and Son [3] found that the rate of

conversion of activation energy is almost constant for different values.

Using the direct dependence of Arrenius, Park, and co-authors [4], he found that the activation energy in the decomposition region of carbonaceous materials at 350–600 ° C was in the range of 146–246 kJ / mol. mol. The area where the evaporation of light organic substances occurs (50-350 ° C), the activation energy is less (19-23 kJ / mol). Separation of atmospheric residues

Different fractions of atmospheric distillation residues of heavy oil were isolated by chromatographic separation. The properties of the oil and the atmospheric distillation residue are given in the table.

Table 1. Properties of heavy oil and its atmospheric distillation residue

Property	Oil	atmospheric residue
Density , °API	12	5,6
Sulfur content,% by weight .	5,29	6,08
Amount of metals mg / kg: Ni		
V	89	97
Elemental composition,% by mass:	441	493
C	83,98	82,56.
H	10,28	10,56
N	0,40	0,74
Ingredients,% by weight:		
Saturated hydrocarbons are aromatic	15,83	11,75
hydrocarbons	36,74	23,66
resins	18,61	34,27
asphaltenes	28,82	30,32

After separation of saturated and aromatic hydrocarbons, resins and asphaltenes, TGA was carried out for each part, as well as for atmospheric residues. The temperature was changed from room temperature to 800 ° C. To determine the kinetic parameters of coke formation, all fractions and atmospheric residues (excluding saturated hydrocarbons) were analyzed at three different temperatures: 8.12 and 16 ° C / min. Thermogravimetric analysis of the saturated hydrocarbon fraction was performed only at a single value of the temperature (8 ° C / min) as it is prone to early thermal decomposition.

Non-isothermal kinetics

Kinetic parameters of pyrolysis of asphalts were determined by non-isothermal method. TGA data were analyzed by the Friedman method and the kinetics were calculated for the first-order reaction. The method is based on the comparison of data

obtained at different linear heating rates. When the form of the kinetic equation is unknown, it can be used to find the activation energy of a number of processes. According to Shuker and Keveshan (1980), the thermal decomposition of heavy components can be described as follows

$$A \rightarrow \alpha(koks) + (1 - \alpha)V \qquad (1)$$
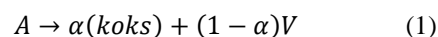
where A is the reagent; V - volatile fraction; α is the stecheometric coefficient for coke.

The following kinetic expression for volatile products can be obtained from this equation:

$$\frac{1}{V_0} \cdot \frac{dV}{dt} = k_0 e^{-E_A/RT} \left[1 - \frac{V}{V_0}\right] \qquad (2)$$

where V_0 is the total amount of evaporated substance. The linear transformation of equation (2) gives the following expression:

$$ln\left[\frac{dx}{dt}\right] = ln[k_0(1-x)] - \frac{E_A}{RT} \qquad (3)$$

where x = V / Vo is part of the volatile fraction, corresponding to the degree of transformation of asphalts during thermal decomposition.

Equation (3) is used by substituting different values of the degree of transformation x ranging from 0.1 to 0.8. The first derivatives of the TGA curves were used to determine the dx / dt and T values for all values of the conversion rate obtained at different temperature rates (8, 12, 16 ° C / min). The linear regression of formula (3) gave a number of values of activation energy (E) and previous exponential factors (k0) depending on the degree of conversion of the asphalts.

Results
Thermal decomposition

Figure 1 shows the results of the TGA analysis of atmospheric residues and other fractions

• Atmospheric residue. The mass varies between 100 and 500 ° C. Initially, evaporation is mainly due to the distillation of light alkanes and lasts up to 350 oC. At temperatures between 350 and 500 ° C, showing the decomposition of heavy fractions - asphalt and resin rapid evaporation occurs. Evaporation between 500 and 800 ° is low and continues at an almost constant rate, with coke output from the atmospheric residue at 16.3 ms. %.
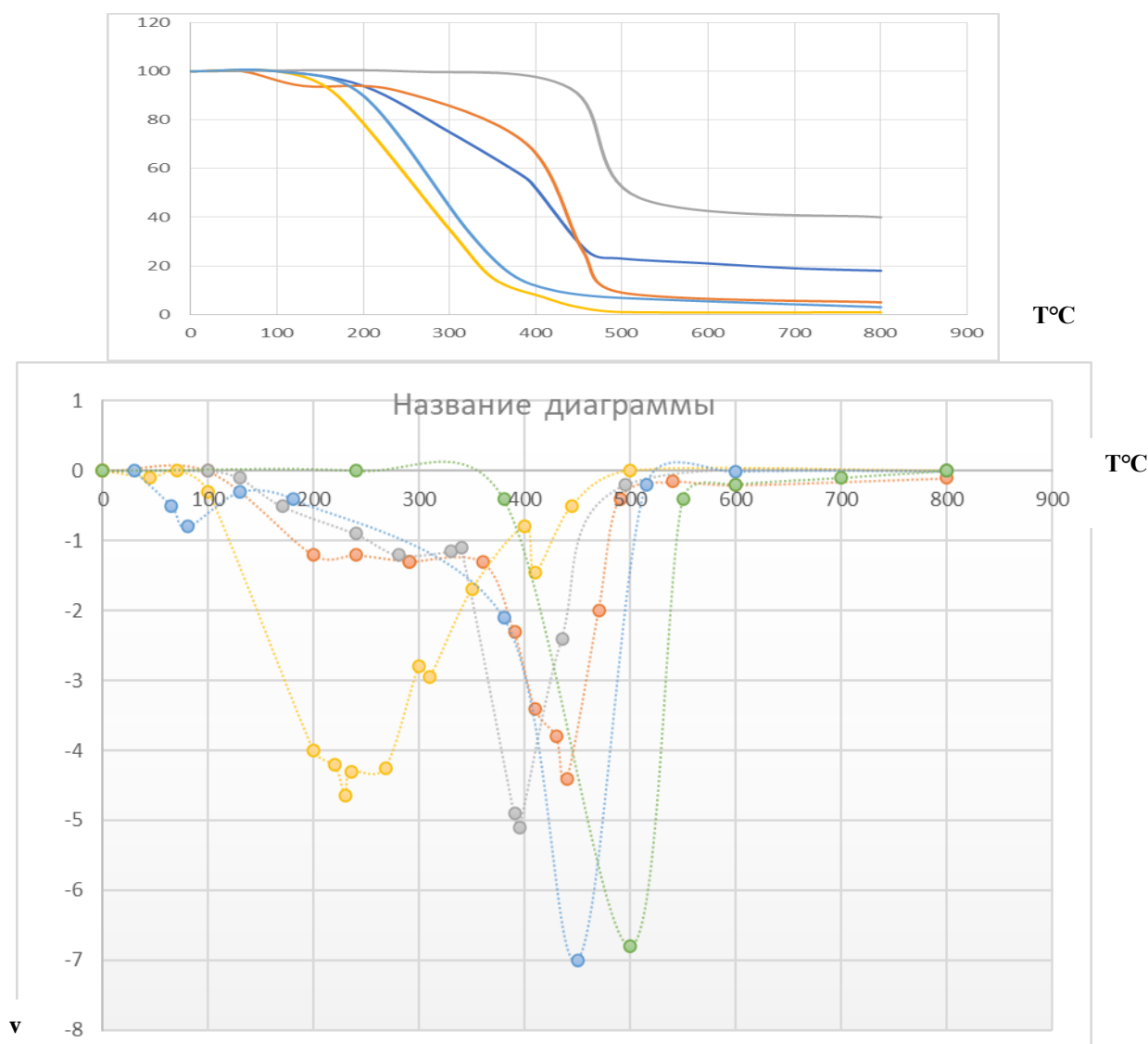
Figure 1. Thermograms and curves of the rate of change of mass of atmospheric residue and its fractions when heated in nitrogen atmosphere at 8oS / min

Asphaltenes. Evaporation from room temperature to 350 ° C corresponds to a conversion of almost 10%. [5] reported that changes observed at temperatures of about 350 ° C could be explained by the removal of alkyl groups of asphaltene structures from peripheral areas.

The most significant mass loss is observed in the temperature range between 430 and 550 ° C, where intermolecular and chemical bonds are expected to be broken, including sulfur bridges and C-C bonds. At this stage, asphalts can be converted into gases and valuable components, ie oils. As pyrolysis takes place between 550 and 800 ° C, asphalts undergo condensation reactions to form coke as a final product. In the range of 600 to 800 ° C, the coke product obtained from the asphalt part remains practically stable (43.1kut.%).

• Resins. Reflecting this fraction gives a 7% mass loss in the range of 50 to 150 ° C, which is light reflects the evaporation of alkanes. Distillation continues between 150 and 350 ° C. Between 350 and 500 ° C, mass loss is accelerated by the reactions of the cracking process. During this period, almost 80% of the resin mass is thermally decomposed. The pyrolysis interval of resins is the widest compared to other fractions. A possible explanation for this is that during pyrolysis, resins can participate in condensation reactions with the formation of heavier molecules, such as asphaltenes [6]. Weakly bound alkyl groups form free radicals that tend to neutralize and condense into larger molecules. After evaporation of most of the light compounds from the initial stages of heating, the remaining large molecules of resin and asphalt formed as a result of thickening evaporate, which explains the extent of pyrolysis of resins. Coke from resins makes up 4.6% of the mass.

• Aromatic hydrocarbons. No significant mass loss occurs at temperatures up to 100 ° C. In the range of 100 to 320 ° C, the most variable is the evaporation of mono-, di-, tri- and higher polycyclic compounds. In the range of 320-480 ° C, resins undergo cracking reactions. . Coke output is 3.8 blunt. About% of aromatic hydrocarbons are very close to resins.

• Saturated hydrocarbons. All compounds of this fraction give very small amounts of coke (0.3 kg.%) Due to complete evaporation. Saturated hydrocarbons are practically not involved in cracking reactions: all changes occur in the distillation phase.

• Thermograms of asphalts and atmospheric residues behave similarly at temperatures below 400 ° C; Between 450 and 800 ° C, it is practically the same. This may indicate that the behavior of atmospheric residues in this range is generally determined by reactions involving heavy fractions such as asphalt.

Figure 1 separately shows the rate of change in the mass of each fraction and atmospheric residue. The maximum rate of change in the mass of asphalts and resins is observed at 467 and 455 oC, respectively. The point of the maximum mass loss ratio of asphalts (467 ° C) is very close to that obtained by other researchers]. At relatively low temperatures (below 350 ° C) the thermal decomposition of asphaltenes continues with the elimination of peripheral groups. At temperatures above 350o C, asphalt structures are significantly reduced in size. In the early stages of pyrolysis, low-molecular compounds are distilled, but it is also possible for larger molecules to break down with the formation of volatile fragments with increasing temperature.

Initially, gases are released as a result of breaking the alkyl chains, but at fairly high temperatures (above 450 ° C) the decomposition of asphalts breaks stronger chemical bonds and breaks down skeletons, increasing the amount of gases released.

Table 2. Values of activation energy and exponential stress depending on the degree of conversion

X	Atmospheric residue			Asphaltenes			Resins			Aromatic hydrocarbons		
	E_A	k_0	r	E_A	k_0	r	E_A	k_0	r	E_A	k_0	r
0,1	11,5	$4,1 \cdot 10^5$	0,989	41,0	$1,4 \cdot 10^{14}$	0,978	10,8	$4,4 \cdot 10^4$	0,992	10,8	$6,7 \cdot 10^7$	0,991
0,2	15,3	$4,4 \cdot 10^6$	0,999	54,9	$1,8 \cdot 10^{18}$	0,998	14,8	$5,9 \cdot 10^5$	0,998	14,5	$7,8 \cdot 10^9$	0,997
0,3	12,4	$1,0 \cdot 10^5$	0,995	56,7	$4,2 \cdot 10^{18}$	0,996	21,1	$3,9 \cdot 10^7$	0,999	14,2	$1,7 \cdot 10^9$	0,991
0,4	12,7	$4,8 \cdot 10^4$	0,991	52,8	$1,6 \cdot 10^{17}$	0,993	35,8	$1,3 \cdot 10^{12}$	0,999	17,6	$4,6 \cdot 10^{10}$	0,992
0,5	20,1	$9,5 \cdot 10^6$	0,985	58,6	$6,7 \cdot 10^{18}$	0,995	45,9	$1,2 \cdot 10^{15}$	0,996	17,9	$1,3 \cdot 10^{10}$	0,990
0,6	24,8	$1,2 \cdot 10^8$	0,994	52,1	$4,6 \cdot 10^{16}$	0,998	49,8	$1,3 \cdot 10^{16}$	0,998	21,6	$1,1 \cdot 10^{11}$	0,992
0,7	27,8	$2,7 \cdot 10^8$	0,994	53,1	$5,9 \cdot 10^{16}$	0,999	47,5	$1,7 \cdot 10^{15}$	0,994	19,8	$8,9 \cdot 10^{10}$	0,994
0,8	30,0	$2,4 \cdot 10^8$	0,980	58,6	$8,1 \cdot 10^{17}$	0,987	48,9	$2,6 \cdot 10^{15}$	0,999	19,2	$1,2 \cdot 10^{10}$	0,994

The most significant conversion of asphalts occurs in the range of approximately 430 to 550 ° C. Compared to atmospheric residues and other fractions, this is the narrowest range in which fission reactions predominate. Coke yield was the same at all temperatures (43.1% by weight) and the activation energy increased to peak values at the conversion levels of 0.5 and 0.8. Asphalt has a higher activation energy than atmospheric residues and other fractions can be associated with. free radicals in the reaction.fracture operations.

. Atmospheric residue is formed by the distillation of lighter components, resulting in the concentration of heavy components in heavy fractions; The only significant reaction to cracking under these conditions.

Evaporation of the resins is completed at about 500 ° C. The coke output is the same at all three values of heating rate (4.6 kg.%). With the increase in the conversion rate, the activation energy changes and reaches the highest values between 0.4 and 0.8. This process can be the result of the decomposition of resins with the formation of free radicals condensing in the form of coke.

The evaporation curve and the Arrenius area for aromatic hydrocarbons are not shown; for them only the values of the activation energy, the pre-reading factor and the correlation coefficient are given in Table 2. The activation energy of this fraction is less than that of asphalt and resins; is approximately the same as atmospheric residues at low conversion rates. Thermogravimetric data show that asphalts contribute the most to the formation of odors; they are followed by resins and aromatic hydrocarbons. In terms of activation energy, the atmospheric residue occupies an intermediate position between aromatic hydrocarbons and resins.

RESULTS

The results show that asphalt is the main coke-forming part. It accounted for 43.1% of the asphalt coke mass. Decomposition reactions should be expected to convert asphalts to gases, oils and resins. Resins and aromatic hydrocarbons produce almost the same amount of coke, but the activation energy of resins is slightly higher. Saturated hydrocarbons evaporate almost completely. Atmospheric residue indicates that the activation energy increases with increasing conversion rate. This indicates that in the first stages of heating, the light components evaporate, and then the heavy fractions - resins and asphalts - begin to break down.

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ISSUES OF ENSURING THE OPERABILITY OF THE MECHANISM FOR CHANGING THE BASE OF A FOUR-WHEEL TRACTOR

Abstract: The growth of the share of mechanization in the total volume of field work in mountainous and foothill areas or on hilly terrain with areas with significant irregularities and slopes is constrained by insufficient longitudinal and lateral stability of serial tractors.To solve this problem, "CTCAE"RLO has begun work on the development of a tractor with a variable track and base.During field and transport work on areas with significant irregularities and slopes where stability is required, the base of this tractor is set to the greatest.At the same time, for processing relatively flat and small areas where a minimum turning radius is required, on the contrary, its base is set to the smallest.The transfer of the tractor from one base to another is carried out by the mechanism of changing the tractor base.Reliability of work, which largely depends on the parameters of its most critical units and parts that are correctly selected when constructing.The conducted studies have shown that the proposed method for checking the reliability of the hydraulic cylinder axis is also acceptable for checking the reliability of the remaining axles of the mechanism for changing the base of the tractor.In the course of the study, it was found that the parameters incorporated in the design of the axis of the hydraulic cylinder withstand the load applied during the operation of the mechanism for changing the base of the tractor and provides the condition of strength in the dangerous section, that is, $\sigma > [\sigma]_T$, therefore, the mechanism is operational.

Key words: tractor, front beam, bar, spar, mechanism, base, track, parts, hinge, hydraulic cylinder, load, slope, stability, controllability.

Language: Russian

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ВОПРОСЫ ОБЕСПЕЧЕНИЯ РАБОТОСПОСОБНОСТИ МЕХАНИЗМА ИЗМЕНЕНИЯ БАЗЫ ЧЕТЫРЕХКОЛЕСНОГО ТРАКТОРА

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Аннотация: Рост доли механизации в общем объеме полевых работ на горных и предгорных районах или на холмистой местности, имеющие участки со значительными неровностями и склонами, сдерживается из-за недостаточной продольной и поперечной устойчивости серийных тракторов. Для решения этой проблемы в ООО «КТЦСМ» начаты работы по разработке трактора с изменяемой колеей и базой. При полевых и транспортных работах на участках со значительными неровностями и склонами, где требуется обеспечение устойчивости, база у этого трактора устанавливается наибольшим. В то же время для обработки сравнительно ровных и малых участков, где требуется минимальный радиус поворота, наоборот, его база устанавливается наименьшим. Перевод трактора с одной базы на другой осуществляется механизмом изменения базы трактора. Надежность работы, которого во многом зависит от правильно выбранных при конструировании параметров его наиболее ответственных узлов и деталей. Проведенные исследования показали, что предложенная методика проверки надежности работыоси гидроцилиндра приемлемо и для проверки надежности остальных осей механизма изменения базы трактора. В ходе исследовании установлено, что параметры, заложенные в конструкцию оси гидроцилиндра, выдерживает нагрузку, приложенную во время работы механизма изменения базы трактора, и обеспечивает условию прочности в опасном сечении, то есть$\sigma > [\sigma]_T$, следовательно, механизм работоспособен.

Ключевые слова: трактор, передняя балка, брус, лонжерон,механизм, база, колея, детали, шарнир, гидроцилиндр, нагруженность, уклон, устойчивость, управляемость.

Введение

УДК 629.114.2

В подавляющем большинстве технологических операциях по возделыванию сельскохозяйственных культур применяются универсально-пропашные тракторы[1-3]. При этомдостижения полноценного использования технико-эксплуатационных показателей этих тракторовсдерживается из-за отсутствия возможности изменения их базы.

Например, рост доли механизации в общем объеме полевых работ на горных и предгорных районахили на холмистой местности,имеющие участки со значительными неровностями и склонами, сдерживается из-за недостаточной продольной и поперечной устойчивости серийных тракторов. Если поперечная устойчивость определяется колеей трактора, то продольная– его базой [4].

С точки зрения продольной и поперечной устойчивости, а такжеустойчивости движения более благоприятна и безопасно работа с машинотракторными агрегатами, составленными на базе тракторов с большей колеей, удлиненной базой и низким расположением центра тяжести[5]. Поэтому при работе на неровных, холмистых участках для обеспечения устойчивости трактора его база и колея должна быть наибольшим. В то же время для обработки междурядий культур, возделываемых в этих регионах, для обеспечения минимального радиуса поворота, наоборот, база трактора должна быть наименьшим. Однако серийные универсально-пропашные тракторы, выпускаемые отечественными производителями, не имеют такой возможности. Для устранения этого недостатка серийных тракторов в ООО«Конструкторский технологический центр сельскохозяйственного машиностроения» (КТЦСМ) разработан трактор с изменяемой базой[6]под условной маркой TTZ-1080 (рис. 1).

Рис.1. Трактор с изменяемой базой TTZ-1080 при: *а - удлиненной базе; б – укороченной базе*

Цель исследования – проверка надежности наиболее ответственных деталей механизма изменения базы и перевода трактора с меньшей базы на большую базу и обратно.

Материалы и методы. В отличиеот серийных тракторов разработанный в КТЦСМ трактор снабжен механизмом изменения базы трактора(рис. 2).
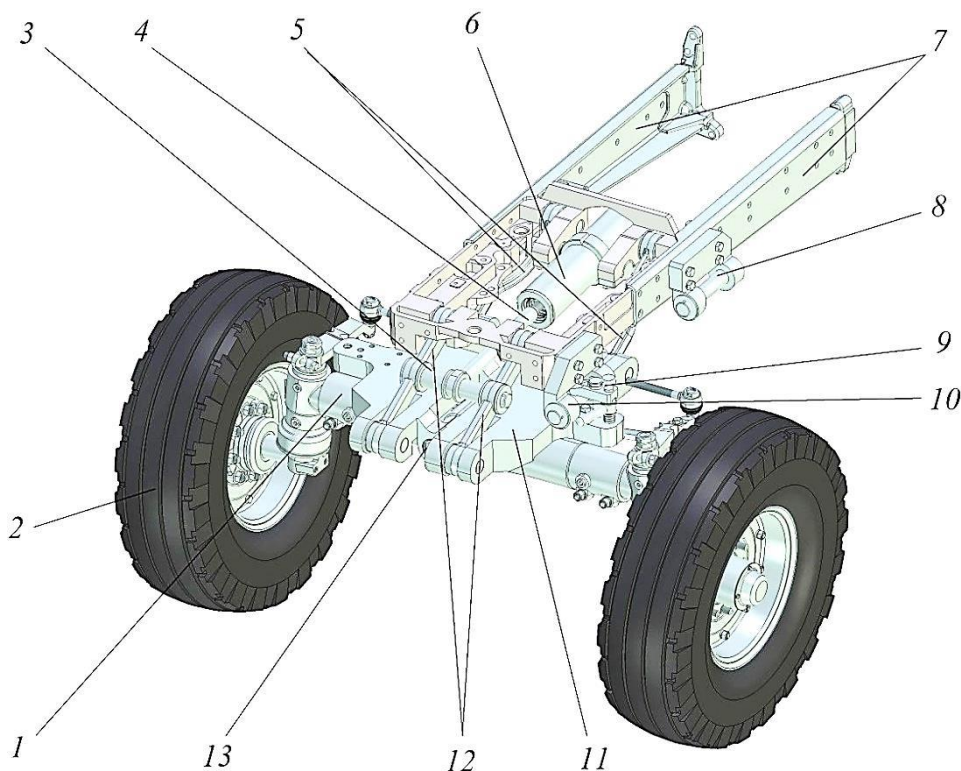
Рис. 2. Механизм изменения базы трактора

Механизм изменения базы трактора представляет собой параллелограммный механизм, вмонтированный между лонжероном 7 и брусом 11 полурамы соединенной посредством оси 13 с балкой 1 переднего моста с направляющими колесами 2 трактора. Шарнирно соединенный между собой лонжерон 7, брус 11, передние 12 и задние 5 звенья представляют собой параллелограммный механизм.

Механизма изменения базы приводится в действие силовым гидроцилиндром 6, который принудительно поворачивает передние звенья 12 параллелограммного механизма вокруг шарнира. Поворот передних звеньев приводит к изменению положения всех 5 и 12 звеньев параллелограммного механизма, следовательно, балки 1 переднего моста трактора. При принудительном выдвижении штока 4 гидроцилиндра 6 производится наращивание базы трактора, если шток задвигается – уменьшение базы. Как показали замеры, максимальное приращение при этом базы трактора составляет 673 мм.

При необходимости увеличения длины базы трактора с помощью гидроцилиндра 6 шток 4 выталкивается в наружном направлении. В свою очередь шток посредством шарнира 3 поворачивает закрепленный с нею звенья 12 и, тем самым, перемещает шарнирно связанный с передними 12 и задними 5 звеньями брус 11 полурамы вперед до тех пор, пока он не упирается к упору 10. Положение бруса 11 полурамы после оперения в упор 10 фиксируется фиксатором 9. Такое перемещение относительно лонжерона 7 бруса 11 полурамы вперед увеличивает длину базы трактора, и она будет максимальной.

Для уменьшения длины базы трактора шток 4 втягивает внутрь гидроцилиндра 6. При этом связанный штоком шарнир 3 поворачивая закрепленный с ним звено 12, перемещает шарнирно связанный с передними 12 и задними 5 звеньями брус 11 полурамы назад до тех пор, пока он не упирается к упору 8. Положение бруса 11 полурамыпосле оперения в упор 8 фиксируется фиксатором 9. Такое перемещение относительно лонжерона 7 бруса 11 полурамы назад уменьшает длину базы трактора, и она будет минимальной.

Результаты и обсуждение. Компактность и безотказность работы этого механизма во многом зависит от правильно подобранных конструктивных параметров наиболее нагруженных деталей механизма изменения базы трактора.

У механизма изменения базы все подвижные элементы: передние и задние звенья, кронштейн и гидроцилиндр посажены на осях. Каждый из передних звеньев выполнено с тремя проушинами, куда посредством втулки вставляются оси. В среднюю проушину вставляется ось гидроцилиндра, а верхнюю и нижнюю проушину - верхняя и нижняя оси механизма изменения базы трактора.

Среди них наиболее нагруженными является ось гидроцилиндра (рис. 3), который обеспечивает передачу толкающего усилия к двум ведущим - передним звеньям механизма изменения базы трактора. Поэтому методику проверки надежности работы осей проводим на примере оси гидроцилиндра.
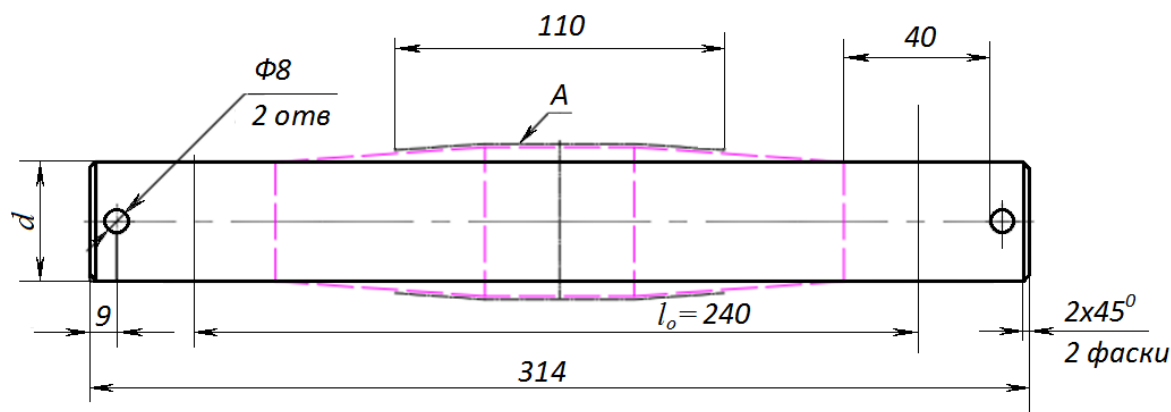
Рис.3. Расчетная схема оси гидроцилиндра

Для оценки прочности осигидроцилиндра механизма изменение базы приняты классические методы механики, применяемые для расчета и оценки прочностных показателей деталей[7, 8].Опираясь на конструктивные параметры, заложенные при первичной комплектации в конструкцию, а также на действующие во время работы на оси усилия (табл.1)определяем прочностные показатели осеймеханизма изменения базы трактора.

Таблица 1. Исходные данные

Наименование показателей	Значение
Колесная формула	4К2
Толкающее усилие гидроцилиндра Ц100 $F_ц$, Н	123213
Усилие F_{10}, Н	42840
Усилие F_{21}, Н	89702
Диаметр осиd, мм	40
Материал	40Х ГОСТ4543
Твердость	37…42 HRC$_э$
Предел текучести σ_T^{40X}, МПа	882,9

Предварительный силовой анализ [9] показывает, что на ось действует изгибающий момент.

Усилия в опорах A и B, определенные согласно расчетной схеме (рис. 4) будут

$$R_A = R_B = 0{,}5 \cdot F_ц = 61606{,}5 \text{ Н}. \qquad (1)$$

Напряжение изгиба при действии толкающего усилия гидроцилиндра

$$\sigma_u = \frac{M_{\max}}{W_x}, \qquad (2)$$

где M_{max} – максимальный изгибающий момент;
W_x – момент сопротивления изгибу поперечного сечения оси.

$$W_x = \frac{\pi \, d^3}{32}. \qquad (3)$$

Условие прочности определяется выражениями

$$\sigma \le [\sigma]_T \qquad (4)$$

и

$$[\sigma]_T = \frac{\sigma_T}{[n]_T}, \qquad (5)$$

где $[n]_T$ – допускаемый запас прочности, МПа.
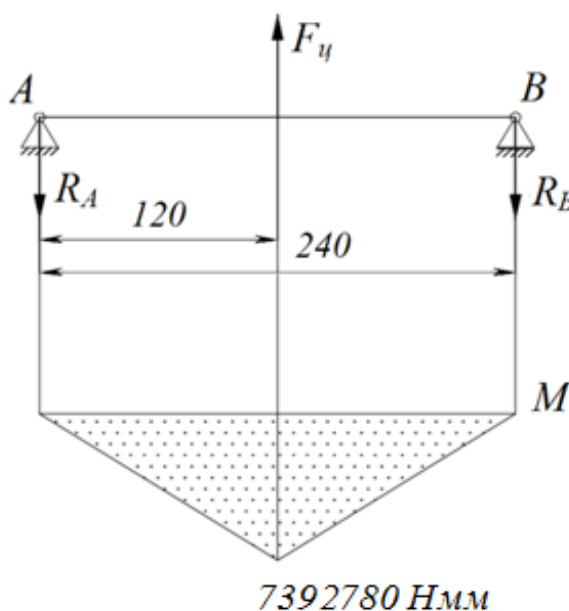
Рис. 4. Расчетная схема

Допускаемый запас прочности по пределу текучести определяется выражением [10]

$$[n]_T = n_1 \cdot n_2 \cdot n_3, \qquad (6)$$

где n_1 – основной коэффициент запаса, учитывающий отклонение механических характеристик от нормативных вследствие нарушения технологии изготовления, наличия остаточных напряжений, значение которого по предельным нагрузкам для поковки составляет $n_1 = 1{,}2$, а для литья $n_1 = 1{,}5$;
n_2 – коэффициент запаса, учитывающий точность определения расчетных нагрузок и напряжений, $n_2 = 1{,}4$;

n_3 – коэффициент запаса, учитывающий ответственность детали, $n_3 = 1{,}2$.

Подставляя числовые значения в (6), получим

$$[n]_T = 1{,}2 \cdot 1{,}4 \cdot 1{,}2 = 2;$$

тогда

$$[\sigma]_T^{40X} = 441{,}45 \text{ МПа}.$$

Результаты проведенного расчета показали (таблица 2) то, что, несмотря на изящность конструкции при выполнении оси гидроцилиндра с диаметром 40 мм условие прочности не выполняется, следовательно, ось не работоспособна.

Таблица 2

M_{max}, Нмм	W_x, мм^3	σ, МПа	$[\sigma]_T$, МПа
7392780	6283,2	1176,6	441,45

Рекомендуется увеличить диаметр посадочного места крепления штока гидроцилиндра с d= 40 мм до 50 мм и обеспечить закалку до твердости 46…51 HRC₃ на указанном участке A.

Как показали результаты предварительного расчета опасного сечения при выполнении предложенных рекомендаций (таблица 3), условия прочности выполняется, следовательно, ось гидроцилиндра работоспособна и выдерживает приложенную во время работы механизма нагрузку.

Таблица 3

M_{max}, кгс мм	W_x, мм^3	σ, МПа	$[\sigma]_T$, МПа
7392780	12272	602,41	637,65

Предложенная методика проверки прочности оси гидроцилиндра приемлема для проверки прочности и других осей механизма изменения базы трактора.

Выводы.

Таким образом, при работе ось гидроцилиндра испытывает нагрузку, вызывающий изгибающий момент в 7392780 Нмм.

Откорректированные параметры, заложенные в конструкцию оси гидроцилиндра, выдерживает максимальный изгибающий момент, и обеспечивает условию прочности в опасном сечении, то есть $\sigma > [\sigma]_T$, следовательно, механизм работоспособен и выдерживает приложенную во время работы механизма изменения базы трактора нагрузку.

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HOW GAMIFICATION INFLUENCES CONSUMER'S BRAND PERCEPTION. GOOGLE T-REX RUN CASE

Abstract: *In today's highly competitive market, which contains millions of different brands, it is a big challenge for marketers to attract consumer's attention to a particular product or brand. The use of game in the design of non-game context has significant impact on brand awareness. This article explains gamification and aspects of perception, learning and memory. In this article, the concepts from the case study – 'Google T-Rex Run!', is applied using the theoretical framework from a consumer behaviour point of view. This introduces a new vision of the topic and academic insight.*

Key words: *gamification, brand awareness, perception, in game advertising, experiment.*
Language: *English*
Citation: Rasulov, S. H., Rasulova, M. S., & Elmurodov, S. G. (2021). How gamification influences consumer's brand perception. Google T-Rex Run case. *ISJ Theoretical & Applied Science, 03 (95),* 48-52.
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Scopus ASCC: 1406.

Introduction

"Digital games have evolved into a mass medium that reaches millions of people" (Terlutter, R.; & Capella, M. L., 2013). Advertising in digital games has developed continually as it is a way to communicate to large number of people who play. However, the use of video games for advertising purposes is not a novelty and can be traced back to the eighties when brands such as Budweiser or Marlboro appeared in video games like Tapper and Pole Position. Nowadays, just in America, more than 150 million people play video games (Entertainment Software Association [ESA] 2015, cited on Parreñoa, 2017).

In early 2011, Deterding et al. (2011b) proposed that gamification is "the use of game design elements in nongame contexts". In recent years, theory of gamification has been applied in many fields, such as education (Rasulova M., 2021; Rasulova M. & Rasulov S., 2021) and science. But in marketing the aims of gamification are different: they focus on increasing engagement, loyalty, brand awareness, and motivation.

Google is one of the most valuable brands in the world (The Guardian, 2018). This brand focuses on

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consumer engagement and loyalty. When using Google Chrome, when the site is experiencing problems or you do not have connection, they implemented an example of gamification: T-Rex Run! This is a game where you play with a dinosaur across a road. However simple that might sound is an effective way of keeping consumers entertained and playing while problems get solved. In other words, through gamification of a site error it contributes to create motivation, engagement and loyalty.

The objective of this report is to explore how gamification influence consumers perceptions of brands. The study focuses on the marketing industry; how gamification is related to perception, learning and memory; using a case study example and literature review.

"As an increasing part of the population is playing video games worldwide, and more audiences can be reached through advertising in video games, advertising in video games is gaining momentum as a marketing communications tool" (Parreñoa, J. M.; Berros, J. B. & Manzanoc, J.A., 2017) .This article is useful in a practical way for the industry as it gives insight to marketeers working on gamification and consumer engagement. Additionally, academically it reviewsconcepts explored by other authors and brings theory to practice with case study.

Literature review and theoretical foundation
Our main research papers analysed are:
Müller-Stewens, J.; Schlager, T.; Haübl, G.; & Herrmann, A. (2017) 'Gamified Information Presentation and Consumer Adoption of Product Innovations'. This article explains main reasons why gamified information is better to perceive. Parreñoa, J. M.; Berros, J. B. & Manzanoc, J.A. (2017) 'Product Placement in Video Games: The Effect of Brand Familiarity and Repetition on Consumers'. The article reviews how effective games are in brand awareness and recognition. Sakas, P.; Kavoura, A.; & Tomaras, P. (2014) 'Gamification in Consumer Marketing - Future or Fallacy?'. This article depicts that gamification is helpful to the advertising strategy as it provides a different brand experience to the consumer. However, it is better when it is implemented in a short period of time in order for the consumer to keep the memory of the brand and not of the game. Terlutter, R.; & Capella, M. L. (2013) 'The Gamification of Advertising: Analysis and Research Directions of In-Game Advertising, Advergames, and Advertising in Social Network Games'. This article analyses advertising in digital games and the perception of customers. Yoo S. & Matthew S. (2017) 'Contextual advertising in games: Impacts of game context on a player's memory and evaluation of brands in video games'. This article examines how positive and negative game contexts influence players' memories and attitudes.

This articles explain gamification and aspects of perception, learning and memory. In this article, we would apply the concepts from the articles to a different case study: Google T-Rex Run!, using the theoretical framework from a consumer behaviour point of view. This introduces a new vision of the topic and academic insight.

Research method and hypothesis development

Hypotheses.
Consumers process of perception is present in gamification. This belief was analysed using the case study of Google. Also, the influences of gamification to brand awareness of that brand was checked .
Theoretical framework.
The theoretical framework is borrowed from the the articles mentioned in the literature review and from the Solomon, M. R., Consumer Behavior: Buying, Having and Being. The articles will be used to establish evidence of gamification and brand awareness. The book will be used to analysed the stages of perception in gamification.
Methodological approach.
The method of the current research will be the systematic review of several articles dedicated to this topic. The articles reviewed include primary experimental data collection and results that will be used in gaining an understanding. The findings will be explained through the example of the "T-Rex Run!" - Chrome Dinosaur Game by Google.
Data analysis.
Consumers process of perception is present in gamification.
First, the case of T-Rex Run! Game was analyzed in accordance with Solomon (2018). The text is used to prove that the stages are present in the game.
The stages of perception in T-Rex Run! By Google Chrome.
1. Exposure: this occurs when a person's sensory threshold is stimulated by something (Solomon, 2018). When it comes to Chrome's T- Rex Run! game, the exposure starts when the consumer is not connected to the internet, waiting for the Wifi to work, or Google is experiencing functioning problems. Chrome presents the consumers with this game stimulating their senses: sight and sound of him/her.
2. Attention: takes place when processing the information is caught and devoted to a particular sense (Solomon, 2018). The consumer has the game in front of them while waiting for the page to work, their eyes see it, they process what it is, and it makes them want to play the game instead of doing something else or leaving Chrome.
3. Interpretation: it refers to our understanding on what is presented to us (Solomon, 2018). The consumer understands that what he or she has in front is a game, and giving the fact that is an easy game to

interpret, the user knows which keyboards to use and starts playing. This appeals to former knowledge stored in the memory of consumers which they have obtained from playing similar games in the past.

According to Marti-Parreno (2017) the use of games for advertising purposes exists since the '80s and children and youngsters are not the only audience for video games, as parents also play. On his article the researcher analyses the effect of repetition and the interaction effect of brand familiarity on consumers' memory through experimental observation among college students. Marti-Parreno's experiment showed that higher repetition of brands placed in video game increases brand recognition and the higher effect was observed in the case of unfamiliar brands (figure 1).
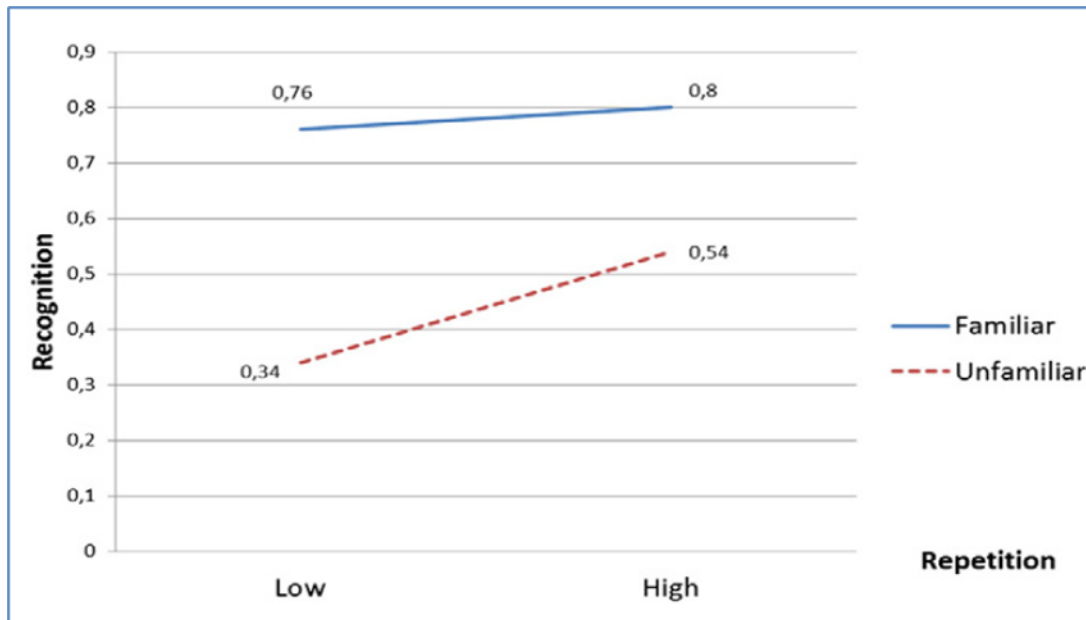
Figure 1. Percentage of brand recognition in each experimental condition (Marti-Parreno, 2017, pp. 55-63).

In his research Yoo (2017) carried very similar experiment among college students. The students played different games with positive and negative context where the brand names were placed. The answers that were given to after-game questions showed that participants had higher level of brand recall, recognition and attitude in the case of games with positive context (figure 2).
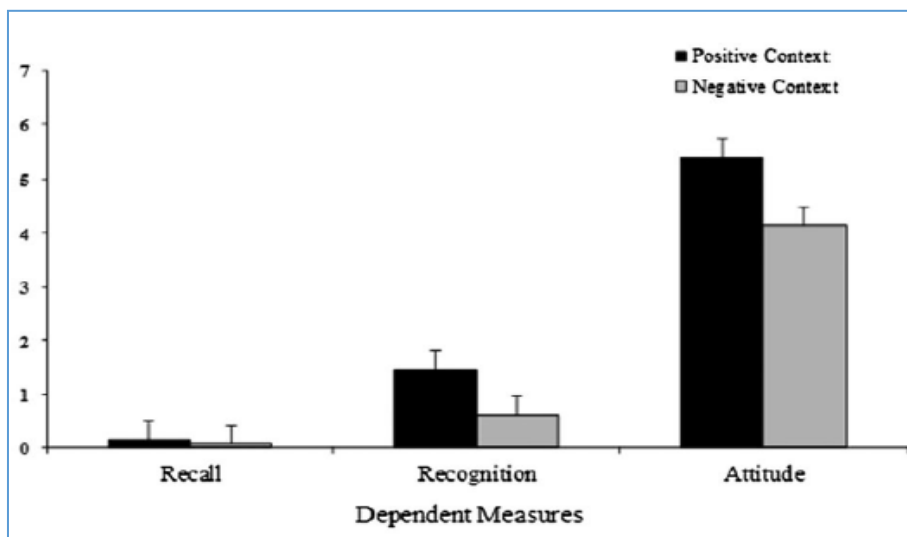
Figure 2. Brand memories and attitudes as affected by the video game context (Yoo & Eastin, 2017, pp. 614-631).

On the other hand, Terlutter (2013) lists different factors that level of recall and recognition, such as game type (e.g., IGA versus advergames), game genre and prominence of the embedded brand. Moreover he refers to the previous studies indicating that brand placements that are featured prominently, i.e., integrated in the story or game play or that can be used by the player (Cauberghe and De Pelsmacker, 2010; Nelson, 2002; Schneider and Cornwell, 2005 cited in Terlutter, 2013, pp. 95-112) lead to improved memory effects. Apart from in-game advertising the gamification of non-game processes also could be very useful tool in increasing brand awareness and brand loyalty among consumers.

One of the simplest example of gamification is 'T-Rex Run!' offline game run by Google Chrome Browser (figure 3). For consumers, time is very significant and the time spent on waiting the suddenly disconnected network to be connected again can lead to frustration. In this situation, consumers might quit using the browser and immediately switch to another one. Google Chrome uses T-Rex Run! to make this process less frustrating so that the users can spend their time entertained rather than angry.
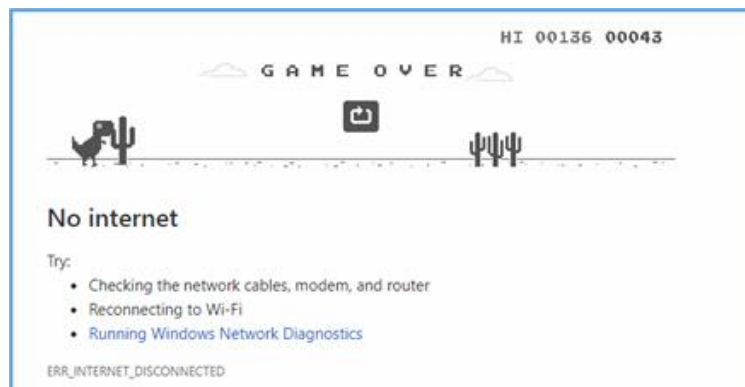
Figure 3. Google "T-Rex Run!"

Results

This article proves that the stages of perception are present in gamification analysing the case study game T-Rex Run! The article also presents a review of papers by Marti-Parreno (2017), Terlutter (2013) and Yoo (2017) which provide evidence that gamification influences brand awareness. These authors state that a higher repetition of brands placed in video game increases brand recognition and that this higher effect was also observed in the case of unfamiliar brands. Also, when brands used gamification participants had higher level of brand recall, recognition and attitude in the case of games with positive context.

Limitations and future direction

One limitation is that the article focuses on one case study, so the findings cannot be applied to all the examples of gamification. The main limitation of this study is that it analyses the Case Study (T-Rex Run!) from a theoretical, secondary research point of view. In order to analyse the effects of gamification primary research could be carried out ot grasp the experience of customers when using the game.

In addition, it analyses the game as far as the consumer plays it. The evaluation of T-Rex Run! by the consumer should also be analysed after the play and regain connection to see the effects of the experience in consumers. Finally, it is yet to be studied if gamification improves loyalty and motivation.

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QR – Issue   QR – Article

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APPLICATION OF INNOVATIVE TECHNOLOGIES IN ENGLISH LANGUAGE

Abstract: this article presents project technology, interactive learning, the use of electronic teaching aids and the use of computer presentations in teaching English.
Key words: innovative technologies in teaching children, trends in modern education.
Language: English
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Introduction

UDC 81-13

Knowledge of foreign languages today is not only a cultural, but also an economic need, a condition for successful human activity in various spheres of production and business. The communicative-speech and socio-cultural development of schoolchildren, the development of their abilities to use a foreign language as a communication tool in the" dialogue of cultures " help students to realize the role of a foreign language as a means of international communication. The trends of modern education, including students, force teachers to keep up with the times , to master new pedagogical technologies. According to the educational standard, English language teaching has two main goals: the development of foreign language communicative competence, which implies the development of speech, language, socio - cultural, educational and cognitive competencies; the development and education of the ability and readiness for independent and continuous learning of the English language: a) further self-education with the help of English in other areas of knowledge; b) the development of the ability to self-esteem through observation of one's own speech in the native and English languages; c) personal self-determination of students in relation to their future profession; d) formation of a citizen and a patriot. The set goals can be realized with the use of all groups of educational technologies, including innovative ones.

The use of innovative technologies in teaching English. In accordance with the modern requirements for the education system and learning outcomes, the educational process is based on an activity-based approach, the use of interactive forms and methods of teaching, the proposed tasks have a personal meaning and are aimed at active speech development. Interactive learning methods are based on collaborative learning or learning in interaction. It should be noted that educational technologies are not used in isolation. There is an active process of their integration. The technology of integrated learning is fundamental in English classes. Integrated classes do not differ from traditional classes in types and forms. These are classes for the formation of skills and abilities, classes for their development, classes for their application in practice, and classes for control and verification. The difference is that all types and forms of integrated classes imply a fairly large information block in the lesson itself and independent work on solving a problem. Based on my experience, I can say that studying the material in small blocks does not lead to the formation of a knowledge system. The process of conscious, deep assimilation of the material slows down. Integrated learning technology allows you to make the process of learning English more effective. Here, this technology is implemented

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through the use of various methods and forms of work. The main task of the teacher is to teach children the ability to independently extract the necessary information, analyze the knowledge obtained and apply it to solve new problems. To do this, I use several technologies described below in my work.

Some ideas that will help develop speech in English in the early years:

Show and say. Give children pets, toys, etc. show pictures of k and talk about them. "Say the names in English" do not try to describe them. and "why do you like this toy?" and encourage other children to ask questions that are of interest to them as well.

Sing songs. This is an important occupation, especially with infants and young children, because there is a very strong correlation between singing and early development of language. Singing with very young children helps them learn to distinguish sounds and recognize rhymes, as well as develop their vocabulary memory.

Roller games and reel games. It can be as complex or simple as you like; you can dress the children in the image of a hero and use them on the stage of the game (with the help of a fictitious plot, or maybe from a book), or you can encourage them to use dolls to tell a fairy tale, or simply encourage a direct role. Play by introducing a few props.

Interactive technologies. Interactive learning is a special form of organizing cognitive activities. It has very specific and predictable goals in mind. One of these goals is to create a comfortable learning environment, such that students feel their success, their intellectual competence, which makes the learning process itself productive. The essence of interactive learning is that the learning process is organized in this way. That almost all students are involved in the process of learning, they have the opportunity to understand and reflect on what they know and think. This is based on cooperation, mutual learning: student – teacher, student – student, while everyone is an equal, equivalent subject of learning. Interactive forms successfully solve the problems of active immersion of students in the language environment, inclusion in the development of

language material through practical activities, helps to increase motivation in learning English, the formation of the ability to solve it independently, the development of skills of independent work with educational material, teamwork, self-control. The educational process takes place in the constant interaction of all students and the teacher. Interactive technologies include active forms and methods, such as: competitive games, role-playing games, round tables, discussions, fantasy classes, carousels, aquariums.

Technology of learning in collaboration. From the first classes in the group, strong and weak students are identified, and in the future this division becomes more and more. A strong student quickly learns the material and does not make mistakes in completing tasks, which means that he has learned how to do it, and he does not need additional practice. At a time when the weak student still needs help and time, the strong student always wants to go forward. Collaborative learning technology helps solve this problem. According to this technology, it is assumed that children will be able to take care of weak students if they work in small groups and are responsible for everyone's success. It is cooperation, not competition, that lies at the heart of learning in collaboration. This also means that each student learns to the best of their abilities and therefore has a chance to be evaluated on an equal basis with others. If everyone expends the same effort to reach their level, it is only fair that their efforts be evaluated equally, provided that everyone has done what they could. Helping a friend, solving any problems together, sharing the joy of success or the bitterness of failure should be natural for every child.

The technology of cooperation solves one of the main tasks in the classroom - ensuring the active activity of each student throughout the lesson, maximizing the speaking time of each. Group interaction aimed at solving a learning task, to which everyone contributes, stimulates the activity of each student. This includes working in pairs with a constantly changing or constant interlocutor, small groups, and rotating (shift) trios.

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FROM THE HISTORY OF RESETTLEMENT (1920-1930 ON THE EXAMPLE OF THE FERGANA VALLEY)

Abstract: The article describes the process of resettlement to Central Fergana of the Yazyavan region in the 20-30th century for the development of new lands. In this process, on the basis of scientific literature, archival materials, construction of new irrigation networks, the expansion of cotton fields, the resettlement of new lands, as well as the benefits provided to the population and the issues of resettlement policy were studied.

Key words: population, resettlement, Central Fergana, facility, credit-acconnodation, National agriculture Comission, Yazyavan, Agrarian ductruct deportment.

Language: English

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Scopus ASCC: 1202.

Introduction

It is natural for every state to try to study its history objectively. As the first President Islam Karimov said, "there is no future without historical memory," history is the future. As the President of the Republic of Uzbekistan Sh.M.Mirziyoev said in his Address to the Oliy Majlis on December 28, 2018, "we must understand our national identity, study the ancient and rich history of our country, strengthen research in this area, fully support the activities of humanitarian scientists. The assessment of the past must be objective, and most importantly, free from various ideological views. "[1.P, 197] The study of the history of Uzbekistan has expanded. In particular, a lot of research is being done on the history of the Russian Empire and the former Soviet era.

Also, the policy of resettlement in Uzbekistan was implemented by the People's Commissariat for Water Resources in the 20-30s of the XX century in order to ensure the independence of the country's cotton. The population was mainly relocated to undeveloped lands on a "voluntary-compulsory" basis. Coercion during resettlement activities and its negative consequences are not fully covered in the documents. In the process of putting documents into

scientific circulation and analyzing them, the historical truth emerges.

Most of the historical documents stored in the archives on this subject are in Russian, and there are many documents in Uzbek written in the Arabic alphabet, as well as documents written in the Latin alphabet. In Russian, terms such as "pereselencheskaya politika", "pereselencheskie meropriyatiya", "pereselenie", "pereselenets", and in Uzbek, the terms "resettlement policy", "resettlement measures", "migrants", and the translation of the word "pereselenets" are often used. The term "nomad" is also used in the documents, the original meaning of which corresponds to the word "nomad" and is therefore considered incorrect.

The main part. First of all, as a result of this policy, the country has managed to solve such an important strategic issue as ensuring cotton independence by further strengthening the cotton monopoly inherited from the Tsarist era, while developing other sectors of agriculture, as well as a relatively sparse, nomadic lifestyle. cultural influence on them by relocating them to areas that are lagging behind in development, an attempt was made to solve the demographic problem. During the relocation, farms were mass-collectivized. Because from 1929

mass collectivization had begun. Of course, most of the socio-economic processes that took place in the village at that time, such as land and water reform, collectivization, had an impact on resettlement policy.

This policy was intended for a short period of time, and both within and outside the district, and behind the republic, vacant land funds were put into circulation. [2, P4-5] There were not only economic and political reasons for resettlement. In particular, the resettlement funds of the republic were located mainly on the borders, and with the help of "reliable" people relocated from the central regions, it was necessary to strengthen them in all respects.

The population of the Fergana Valley is very dense, and in the southern regions of the republic the population is small, the land is not used properly and rationally. Correcting this "mistake" and further increasing cotton production was the economic reason for the resettlement policy.

Due to the special attention of the Soviet government to this event and the short time allotted for its implementation, this task, the relocation work, the relocation apparatus under the People's Commissariat of Land and Water Resources could not be carried out alone. , as well as the need to involve the entire population [3, P1-2]

The Fergana regional branch of the People's Commissariat for Land and Water Resources and the commission for the development of new irrigated lands in Yazyavan district will be tasked with strengthening land reforms.

Among the new irrigated areas are Karasakal, Yazyovan, Khanabad, Qoratepa in Yazyovan volost, Kumarik in Yakkatut volost, Naiman, Boston, Bolalik in Kokand rural volost and Telmon. Based on the conclusion of the Commission that the vacant land funds in these areas are suitable for resettlement, it is planned to pursue a resettlement policy.

The commission will determine the suitability and suitability of these sites for habitation, and the draft drafted by the district development commission will be sent to the subcommittee on land development for approval.

According to the project of construction of new villages, the construction of neighborhoods with 100 to 150 apartments, the size of the courtyard should not exceed one tenth, the width of the street: main - 6 sarjins, secondary - 4 sarjins, field road - 3 sarjins, large passage - 6 sarjins, distributed for public places no more than 4 desiatinas. Allocation of no more than 2 desiatins for market areas, in villages with markets, designing the width of the main street to 10 sarjins, total land area and rural land not exceeding 4 desiatins, transfer of lands cultivated in 1925 to the general fund during the construction of new irrigation facilities, and this to the landowners, with their consent, the allocation of land near the boundary of their villages, equal to their land, is determined. [4,

P1-2] In some cases, very small villages were also built for the population.

Measures have been taken to continue the resettlement in Yakkatut and Yazyavan volosts. According to him, in order to develop the lands of Yazyavan and build irrigation facilities, resettlement measures have been developed. However, it is noted that these lands have been owned and neglected for 5-6 years. One of the main reasons for the neglect of the lands was the lack of waterworks. Therefore, water reforms were carried out simultaneously with the development of vacant land funds. Landless farmers, farmers with a small amount of land, local hard-working farmers, laborers were involved in the implementation of the planned measures.

Such a task was required to be completed strictly and in a timely manner, as well as the responsible approach of the staff of the District Commission. Long-term interest-bearing loans, as well as other forms of loans, as short-term and long-term loans, are provided by the government to the resettlers living in the resettlement areas by the Agricultural Construction Bank or its local branches. [4, B - 22] Loans are issued for the following needs:

a) working animals and inanimate inventory;

b) purchase seeds for planting;

c) for housing construction and economic organization;

d) small irrigation networks and hydraulic structures;

d) for the construction of public buildings.

Loans in these forms are loans to all farms that have received loans and must be repaid to the state in the prescribed manner.

Some incentives, in particular loans, are allocated to individual farms or groups for the purchase of large cattle, small equipment, seeds, housing and farm buildings. Loans for the construction of irrigation networks, equipment, hydraulic structures, public buildings were provided to farms in a special order.

Arbitrary occupation of state lands in violation of the rules of resettlement and land management is prohibited without a mandate, certificate, documents on the allocation of land plots provided by land authorities. [6, P-22]

The transfer procedure was as follows. Registered plots of land attached to immigrants are retained for a period not exceeding one year. Construction of a small irrigation network and cleaning of other existing irrigation networks were to be completed from 15 December to 1 March. If farmers do not move to a plot of land during the year, they lose their right to land if the canals are not cleaned, resulting in the land being transferred to another farm. Farmers who receive a land ownership certificate from the Irrigation Agency will be exempt from agricultural taxes for five years. [7, P-3]

It is also stipulated that in the process of relocation, the certificate must be submitted to the district land department as a document authorizing the relocation on a preferential rate. Road ticket certificates are issued by the county land department only to registered landowners. Land plots on relocation plots were not arbitrarily allocated to farms that did not have land plots registered and did not have a travel certificate, which did not entitle them to the benefits provided for resettlers. County land departments were required to assist in moving from exit points to new locations and in transporting their cargo.

In 1929, 81 out of 685 farms in Andijan region were transferred to Zarafshan district, 202 farms to Tashkent district, 102 farms to Surkhandarya district. From February 19 of the same year, 81 farms sent to Zarafshan district consisted of 103 adults and 3 children, and on February 21, 202 farms sent to Tashkent district consisted of 260 adults.

Collective farms were established on new lands by the district land department of the relocation and land management apparatus. During the implementation of internal resettlement, measures were taken to unite farms in districts and villages.

During the relocation, loans and benefits were provided to the population, which were spent on agricultural inventory and seeds. But the population faced certain difficulties in the places where they moved. For example, B. Batirova's work says: "Although the policy of resettlement is voluntary, it was carried out on the basis of strong pressure. Since the population relocated to the designated areas was relocated to steppe and tugai areas, most of them lived in reed huts, basements, and huts. This has been the case for many years, and the asylum issue has not been resolved by the government. The supply of food and industrial goods was also poor. In some places, there were interruptions in food supply for three months. However, the Soviet government had previously promised to provide shelter and food to the displaced. [8, P -291]

This situation has caused some farmers to leave their migrating lands. The People's Commissariat of Water Affairs and the Central Crop Commission recommend that all returnees leave for their places of residence, otherwise they will be required to return all funds and means they received for resettlement. [9, P-13]

In the spring of 1930, the relocated farms were allocated funds for the organization of agriculture, tractors. For example, Andijan district has 221 plows, 442 wooden hooks, 442 shovels, and 22 tractor-mounted mowers. [10, P176] This supply was not enough to develop new lands. difficulties arose during the management of the farm.

In January 1931, a letter was sent to the Andijan branch of the Land Management Department of the People's Commissariat for Irrigation and Water Resources, and to the Central Asian Agricultural Lending Department of the State Bank. Therefore, it is necessary to compile a list of those who escaped from the resettlement funds, indicating their names, whereabouts, amount of money received, address, and to be signed by the district land department and sent to local departments. It is said that measures should be taken to recover debts from displaced persons. [11, P-5]

Also, an urgent telegram will be sent to the village councils on behalf of the Central Crop Commission, the district crop commission, the district land departments. The attached part states that a list of the names and surnames of all displaced persons should be drawn up and immediately sent to the district land department, and the refugees should be returned, accommodated, provided with food. Those who refuse to return to the relocation funds are required to immediately collect debts from the kolkhozes, state and organizations of which they are members.

A search was conducted to carry out this work. This task was entrusted to the representatives of village councils, local crop commissions. [12, P11-12] This task has been assigned by the People's Commissariat of Water Resources to all district and district land departments. During the repatriation of refugees, it is also revealed that all those who moved left their lands and returned to their former places or went in a completely unknown direction. As a result, district land departments and resettlement agencies are accused of weak control over the status of relocated farms. Visits to the relocation sites by the district land department management are also said to be insufficient.

In conclusion, it can be said that the majority of the displaced population were poor and landless peasants. They were mainly relocated to undeveloped steppe and desert areas, in particular to the Yazyovan district of Fergana oblast. Therefore, loans and benefits have been allocated to the resettled population. But they were not aware of their condition, and there were even cases of food supply interruptions for months. Therefore, there have been cases of displaced people leaving their relocated lands. But even so, the resettlement policy will continue for decades as the government takes the necessary measures.

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CREATIVENESS AND ITS IMPORTANCE IN PROBLEM SOLVING

Abstract: The article examines the essence and importance of creativeness, the characteristics of a creative person, its advantages, the evaluation of creativeness, the theoretical basis of the criteria for creativeness.
Key words: thinking, creativity, conflict, ability, hypothesis, invention, talent, system, criterion.
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Introduction

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Creativeness (English create-create, creative-creative, creativity) is a creative ability, characterized by a willingness to create persistent new ideas that deviate from traditional or ordinary thinking traditions and enter the structure of talent as an independent factor, and are capable of instantly solving problems that arise within static systems.

Personality creativeness is manifested in his thinking, communication, feelings, certain types of activity.

Creativeness-as an ability to think creatively, is often perceived as an important indicator of ability. At present, there are no generally accepted guidelines on how to recognize creativity in young children and even the presence of creativity. For example, someone can be creative original in the formulation and solution of problems related to physics, but cannot be a writer. In addition, someone can be creative in one or another field, but only in certain periods of his life.

Creativity plays an important role in determining perfection. The form of talent always manifests itself in a certain field. No one can be creative or resourceful in everything. Studies show that many creative people can be considered talented, but not all talented people are creative.

The founders of the creativity test are J. Gilford and P. Torrens. C. Gilford believes that thinking is divided into two parts – convergent and divergent thinking, which indicates that the ability to think differently allows solving various problems leads to unexpected conclusions.

At present, it is necessary to focus your work on the creative approach to the proposed training programs, as well as on the development of the potential of students. The modern process should take into account the individual characteristics of the students, their interests and needs. Readers should not only see, but also believe in it, understand its importance, answer interesting questions independently, help in the process of self-realization.

In order to formalize the creativity of the individual in R.Sternberg's work of praise, adults should not be limited to the creative abilities of children, that is, they should demonstrate their creative behavior.

In fact, a creative person is one who intuitively feels the need to create a new idea, to add one detail or twist everything to the opposite side, to produce something fundamentally new, or to demontage and lay down something already familiar, in a different way, to find a way to act contrary to existing stereotypes or simply look at static systems. Creativeness in a person:

• it will help to solve the problems that have arisen, since the very beginning of the idea helps to get out of the situation better;

• helps to find the most unusual ways to develop thinking in a person helps to find motivation;

• makes life infinite variety-HIL;

• creativity makes it possible to realize the views of the reader;

• self-awareness will help to find ways.

Famous A. Maslou-in his opinion, creativeness is a creative direction, and all will be inseparable innate, but he believes that in the influence of the environment this ability can be lost.

G. Altshuller knew creativeness was "inspiration by order." Since then, disputes between the theories of creativity and invention have been continuing. Perhaps, many of us have repeatedly faced the lack of inspiration and ideas. We offer several techniques that can give you the right idea.

Method of mental attack. One of the most common and used methods. Several readers offer their own ideas and opinions on a particular problem. The main thing to remember is to say without hesitation any idea.

The method of synthetics. The establishment of associative connections is based on the characteristic of the brain. 4 type of analogies are used. True, directly symbolic, fantastic, personal.

Creative abilities-the ability of a person to create new ideas in creative decision-making. Creative abilities are manifested in everyday life as a resourcefulness, the ability to achieve a goal, the ability to find a way out of a desperate visible situation by using the environment, objects and circumstances in an unusual way.

In a broad sense, a trivial and skillful solution of the problem and, as a rule, a solution with non-specialized means or resources. It also implies the ability to solve problems confident, non-standard.

On the issue of whether it is possible to develop creativeness – scientists have expressed their different opinions.

In order to understand the general essence of the process of developing the qualities of creativity in a person, it will be necessary to know the meaning of the concept of "creativeness".

For Example, According to E. P. Torrens, creative challenges include high exposure to deficits, deficiencies, or cognitive deficits, as well as actions on the basis of proposing hypotheses to identify those problems, describing the outcome of a decision to investigate and modify hypotheses, he says.

When assessing creativity, various types of thinking tests, analysis of personal questionnaires are used. For the purpose of facilitating the development of creative thinking, it is possible to use educational situations in which it is not complete or characterized by Transparency in order to combine new elements, at the same time students are encouraged depending on the formation of different questions.

An expert and experimental assessment of the individual's ability to acquire knowledge shows that the creativity of the student is not so great. Continuous improvement of the educational institution can be achieved only by attracting all pedagogical staff (Kaydzen method), sharply increasing the creativity of the educational institution. There are psychological means that measure creative thinking. E. famous in the world psychological experience. P. Torrens test. This test allows you to evaluate: oral creativeness; expressive, vibrant creativeness; exceptional creative abilities; fluency; flexibility – this indicator assesses the diversity of ideas and strategies, the ability to move from one aspect to another; self-esteem, this indicator characterizes the ability to push forward ideas that are different from the usual, familiar, universally accepted, accustomed or decisive decisions; the ability to see the essence of the problem; the ability to resist stereotypes.

The main criteria for the formation of creativeness are the following:

Fluency is the number of ideas that arise in a unit of time; originality is the ability to create unusual ideas that differ from generally accepted ideas; flexibility-the significance of this parameter, as Rango points out, depends on two circumstances: first, this option allows to distinguish flexible individuals in the process of solving a problem from those who are determined to solve them; ; impressiveness is a sensitivity to unusual details, contradictions and uncertainties, the desire to quickly move from one idea to another; metaphor, willingness to work in completely abnormal conditions, a tendency to symbolic, associative thinking, the ability to see a complex simple problem in complexity; satisfaction is the result of creativeness. With a negative result, the meaning of feelings and further development disappear.

According to Torrens:

fluency – the ability to create multifaceted ideas; adaptability – the ability to use a variety of homogeneous strategies in solving problems; originality (self – esteem) – the ability to think of unusual, non – standard ideas (thoughts); Development (Research) – the ability to piece together the thoughts, ideas that have arisen; resistance to humanism-the ability to "stay open" for a long time without paying attention to various stereotypes in solving the problem; ability to get noticed. The title

process reflects the ability to switch the figurative information into an oral form. In addition, there are norms, such as the ability to appear large number of ideas.

The presence in a person of the above abilities is an indication of his creativeness or creative potential. The character of the person is important in improving the gameplay and quests.

It turns out that creativeness is a significant advantage that helps to surpass opponents in all spheres of life. Developing creativeness is an important prerequisite for success.

There are several hypotheses on the origin of creative abilities. According to the first hypothesis, creative abilities in a conscious person are gradually, for a long time, cultural and demographic changes in the human race are, in particular, as a result of the successive strengthening of characteristics in the generation, the reproduction of the shells of intelligent and intelligent students, the growth of the number of pupils. In 2002, the anthropologist of Stanford University on the second hypothesis noted by R. Clay, creativeness was characterized by Jump-Jump development. It is estimated that 50 thousand years ago the full-fledged genetic mutation appeared as a result.

Creativity is the ability to make unexpected decisions based on existing knowledge or experience. The conclusion is that creativeness is a creative opportunity that helps a person to create some kind of innovation. Here from all his youth he got used to the word" creativity".

The conclusion is that creativeness is a creative opportunity that helps a person to create some kind of innovation. Here from all his youth he got used to the word "creativity".

Does creativity replace or complement creativity? - there is confusion in the matter. The enema is simple. Creativity is a process, and creativity is a skill that helps to engage in creativity. That is, whoever has developed creativeness, his creativity will be much lighter. Creativity-given the non-standard approach to the performance of the tasks set, it is worthwhile to conduct a non-standard approach to the development of creativity. Unlikely to put himself in the place of a film or computer game hero when someone from US tries to solve any issue. Why would not it be so? After all, one head is good, two are good at it. Let the second head of declination also be fictitious. Hiding the whole beauty of creativeness – full of action land and endless imaginary fantasy.

The absence of superposition in the reader is associated with the inability to first believe in the present (that is, there are no fantasies, dreams, wishes and desires). Such a method will come to hand not only to increase creativity and overall chances, but also in certain life situations. For example, some frail schoolboy is returning home at night. On a dark street, several people approach him with bad intentions in front of him. Then, knowing that all material problems will fall on his shoulders, screaming at his friends from behind with a loud voice, says that they will come faster and interfere with the situation.

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THE ROLE OF INFORMATION TECHNOLOGY IN THE DEVELOPMENT OF SPEECH COMPETENCE

Abstract: The article contains the analysis of approaches to definition of competence and professional integrity and their diversity.
Key words: language competence; language competency; language system; substantive aspects of the concept of competence; language competence's components
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Introduction

Modern society is experiencing an era of globalization. The closeness of states has almost disappeared, cultural and national differences are being erased, and communication is becoming limitless. Under these conditions, the role of a single world language as a means of uniting people is extremely growing. English has become such an international language. It is the world's third largest native speaker (after Chinese and Spanish), with about 1.5 billion people speaking English, and another billion learning it. It is the language of diplomacy, computers, science, media, medicine, aviation.

Formation and development of personality, its successful socialization is based on familiarization with universal and national values. Without familiarization with the speech culture of society, the formation and development of an educated person is impossible. The ability to correctly structure your oral and written speech is the most important part of any professional activity. Even Napoleon warned: "Anyone who cannot speak has no career will do". Process qualification requirements to graduates which are expressed in concepts competence and competence were developed is focused. Approaches existing in special researches to definition of concepts competency and competence are analyzed, their nonidentity is proved. Competency is basis for

formation and competence development. Competency is formed in purposeful process of education. Development of components of separate competency happens gradually, by means of specially organized integrated educational spaces. Competency is, first of all, the objective requirements imposed to professional personally level of the person, carrying out a certain kind of activity, this ability of the subject to carry out actions and functions of the certain kind of activity, based on necessary knowledge, skills, personal qualities and valuable orientations.

Role of implementation modern information technologies must be considered not just in the use of innovative means, but in how the way of life, thinking and behavior of a person under their influence. Innovative approaches to language learning should be considered in inextricable connection with a fundamental change in the entire educational process, with the revision of established norms and principles, the relationship between teacher and student [1]. Comprehensive reform of the education system provides for the search for new methods, forms and principles of teaching. And one of the necessary components of this process, which is already has confirmed its effectiveness, is the introduction into educational system, including the study of foreign languages, new information technologies. Information computer technologies (ICT) are now recognized as

one of the most important directions of optimization of the educational process [2], which confirmed by the resolution of the President of the Republic of Uzbekistan No. PP-2909 04.24.2017 "On measures for the further development of the system higher education".

It notes a key role in the comprehensive reforming the higher education system modernization of educational process by updating curricula and materials, using the latest educational technologies, filling material and technical base with modern means and improving information support [3]. Without introduction to speech culture society, the formation and development of an educated person is impossible, therefore today the main task of all who organizes a humanitarian educational environment, is the formation of speech competence.

Speech competence - free practical command of speech in a given language, the ability to speak correctly, fluently and dynamically both in dialogue and in the form of a monologue, good understanding of audible and readable speech, including the ability to produce and understand speech in any functional style; is an integral part the culture of the individual. Speech competence determined by language competence, wide speech practice of communication, a large volume of reading literature of different genres and determines the communicative competence. Note that, in contrast to linguistic and communicative, speech competence is of a discursive nature and reflects the quality of verbal behavior requirements-oriented trainees profession. Speech activity performs a binary function in relation to a person: promotes, being a part of speech and thinking activity, the development of personality and mirrors its essence. It is no coincidence that a few centuries ago Socrates uttered a remarkable the phrase: "Speak so that I can see you."

Competence as an objective characteristic of reality must pass through activity in order to become competence as a characteristic of a person. Experience as an activity component of the competence-based learning model is the cementing basis the process of formation of competence: activity becomes the subject of assimilation. In the process performance by the trainee of a certain complex the goal of "learning by doing" is achieved: bridge the gap between what a person knows and by what he does. Competences are, in our opinion, met subject formations, so how are they formed through specially organized integral educational spaces. In the integral educational space, not a specific discipline or even their complex is studied, but some kind of scientific phenomenon, event, phenomenon technical activities, cultural or social life, recreated using a theoretical model. It is based on the content of several disciplines, but not equivalent to them. Integral space correlates with a group of educational courses, but not limited to it. In an integral educational space, a student takes center stage, his consciousness acts as an integration factor. Competencies determine the personality-activity approach in education, since they are important components of modern personality and are identified in specific activities.

Thus, competence can be defined as a set of relevant knowledge, abilities and skills, some standard that will later be expressed in the competence of the individual, more specifically - in her practical activities. The content of the concept of competence involves the inclusion of the following aspects:

a) motivational (readiness to display competence);

b) cognitive (possession of knowledge);

c) behavioral (experience of manifestation of competence in various standard and non-standard situations);

d) value-semantic (attitude to the process, result and content of competence);

e) regulatory (emotional-volitional regulation)

All of them are found in the linguistic competence. The place of linguistic competence in the existing classifications of competencies is determined quite accurately. According to most scientists, it is a component of communicative competence, which is one of the key, that is, "the most general (universal) abilities and skills that allow a person understand the situation and achieve results in personal and professional life in an increasingly dynamism of modern society". Depending on the main types of speech activity, the methodology of foreign languages distinguishes four basic skills: the ability to speak (in dialogical and monologist forms), the ability to write, listening skills and reading skills. Each skill is based on its own group of skills, which are synthesized by functioning in the skill. Taken together, speech skills and abilities ensure correct construction and implementation statements. Speech operation is a unit of the speech-thinking process, characterized by unconsciousness, automatism and stability in its implementation. According to A. Leontiev's definition, speech operations brought to perfection are called speech skills. The competence model of higher professional education assumes the following important target guidelines in the design of the educational process at the university:

• student-oriented orientation educational process;

• organic inclusion of educational the environment of the university in all types of life of its subjects, leading to the activation of the internal resources of the individual;

• personal development in professional becoming;

• focus on competencies as results education taking into account the requirements of the labor market and international trends;

• saturation with personal meanings and humanization of the content.

New information technologies and modern means of computer teaching foreign languages can be used: for the formation of both receptive and reproductive skills; for the formation of skills in all types of speech communication; on any stage of training; based on various forms of work (extracurricular and classroom: individual, steam room, group, in the presence of a teacher and without him); for any level of training (from beginner to advanced); within the framework of various approaches to learning (from programmed learning with tight control to free navigation of the student in the educational virtual electronic environment).

Summing up the above, it should be noted that information technologies and the Internet have become an integral part of modern world culture. Therefore, it is natural that they have also become an important element of modern education. It is assumed that every person should be a confident computer user, understand the possibilities and technologies of electronic communication and the Internet. In this regard, teachers of foreign (English) language in universities can fully use the opportunities offered by combining language teaching and information and communication technologies, given that more than 50 % of Internet sites are presented in English, which is far ahead of the Russian language (6.3%), German

(6.3%), Spanish (5.1%), Japanese (4.2%) and French (4.1%) languages [10].

The author's teaching of a foreign language using modern information and communication technologies allows us to solve the following pedagogical tasks [3]:

- increase students ' motivation to learn a foreign language;
- develop the ability and willingness to learn English independently;
- overcome the language barrier;
- develop speech competence: the ability to understand authentic foreign language speech or text, as well as the ability to convey information in coherent reasoned statements;
- increase the amount of linguistic knowledge;
- acquire cultural knowledge;
- to form the concept of a global worldview;
- develop creative abilities.

Thus, the author's involvement of various forms, methods and means of teaching using information and communication technologies and Internet resources in the educational process suggests that they provide more effective assimilation of educational material by students, as well as the communicative and professional competencies they need in their future work.

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FEATURES OF THE COMMUNICATIVE APPROACH IN TEACHING ENGLISH

Abstract: *The main features of the communicative approach in teaching English and possible problems that may arise are discussed in this article. Since this is a student-centered method, the teacher must re-evaluate his position in the classroom and understand that the traditional class has changed significantly.*

Key words: *communicative approach, the formation of communication skills, obtaining the most beneficial results, native speaker, teacher behavior model.*

Language: *English*

Introduction

For many years, grammar teaching has continued to occupy an important place in the teaching of English and foreign languages, leaving students with less time or energy to speak, read, or write in these languages. Since then, hundreds of such studies have led to some clear and unambiguous conclusions: teaching formal grammar (memorizing grammar rules) does not help students to speak, write, think, or learn languages [1].

The purpose of teaching grammar is to enable students to complete their communication tasks. This goal has three meanings:

- Students need instructions that connect grammatical points to broader communication contexts.

- Students do not need to master every aspect of every grammatical topic, only those that are relevant to direct communication are needed.

- Correcting mistakes is not always the primary responsibility of the teacher.

The key to greater understanding is to provide context for the facts and rules. The context becomes a link to increase the memory of these facts and rules. This is especially true for abstract concepts, such as grammatical rules.

An important part of teaching grammar is using examples. Teachers should carefully plan their examples around two basic principles:

- Make sure that the examples are accurate and relevant. They must represent the language properly, conform to the cultural context in which they are used, and be at the level of the class.

- Focus the examples on a specific topic, so that students have a better understanding of specific information and vocabulary, and can use the material they have learned in real life.

The main features of the communicative approach in teaching English and possible problems that may arise are considered. Since this is a student-centered method, the teacher must re-evaluate their position in the classroom and understand that the traditional classroom has changed significantly. Teaching English as a foreign language has long defined changes in the pedagogical sphere and methods, and continues to do so. The most important aspect is that the focus has shifted from teacher-centered classes to student-centered classes. This aspect introduced new rules and attitudes, especially for the teacher. Modern pedagogy has realized that the classroom is a balanced two-way relationship between the one who teaches and the one who learns. Thus, the two parts "discuss" their importance in the classroom

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in the sense that for better learning, the activity of the one who teaches must become more or less dynamic or involved. He is the only one who knows, the one who puts things in order over time and understands the best attitude towards his partner.

The most important job of a teacher is to create an environment in which learning can take place. I think we should conclude this statement by saying that the teacher creates an environment in which better learning can take place. Because we strive for optimal performance in order to obtain the most profitable results. Thus, the communicative method has an adequate relation to this goal. He sees interaction in the classroom as an important pedagogical principle. However, this concept of classroom interaction was misinterpreted, as it was identified only with teacher-student interaction. It is very important for the student to listen and talk to the teacher, since it is the teacher who can decide whether the required level of knowledge has been achieved. Students always look at the teacher who teaches them as a person who has the necessary ability to observe, understand and, most importantly, correct mistakes. But this is not always the best way to learn, especially when it comes to a foreign language. The student learns a lot from what he hears from the teacher or from the recording.

Thus, by interacting with the teacher, the student learns to interact with a competent native speaker. When learning English, students get a language - because the language is in some way the subject of communication of students (whether they want to get it or not). But this is not enough: the teacher also needs to give students the opportunity to activate this knowledge and "reproduce" the language. Supervising teachers need to know when and for how long they need to allow students to speak, because language production involves rehearsal or learning outcomes. If teachers forget to "get out" of the position controller, students can no longer practice the language, so their conversational skills can be severely affected. It should be noted that "fine-tuned input" is often the "goal" of a new language presentation, where repetition, teacher corrections, discussion, techniques/discoveries are often used to advance cognitive strategies. At the presentation stage, teachers usually act as supervisors, choosing the language that students should speak and demanding accurate reproduction of new language elements. They want to pretty strictly correct the mistakes they hear and see at this stage, which are usually suggested in practical and communicative activities. To get the best results in a student-oriented class, you need to make sure that the task is clear to them.

Sometimes, when a teacher invests energy in finding the best way to instruct, they may lose sight of the need to attract students ' attention before instructing. It is very important for the teacher to know what his role is in the audience, especially in a pair or group work. "Immediately after you have given instructions for a task and the students have started to perform it, there is often an immediate need to check that the students are doing the action you asked them to perform, and understand the basic instructions and mechanics of the activity. You can make it a quiet and relatively inconspicuous walk around the room, briefly listening to excerpts from many groups and making sure that the students are doing what they are supposed to do. We could do this monitoring to test the mechanics."

In most classes, the goal is for students to work on their own for as long as possible; to speak freely with minimal intervention from the teacher. Having a teacher can sometimes be perceived as an intervention. To clarify: if the teacher is "too active", students will turn to him for advice, correction, or vocabulary help, while it may be more useful for them to struggle a little and learn how to use their own resources. In this way, the teacher's behavior can range from imperceptible observation to disappearing completely, shape the activity. However, in some assignments, especially those in which students need advice, help, or support, the teacher may become more involved in the activity and become more and more active. In these cases, the best option for the teacher is active supervision or control. Covertly controlling means maintaining a certain presence of yourself as a teacher in the classroom, but not offering help or interfering every time something seems wrong. And the students should know that the teacher is here, but he will not interfere with them. The teacher attentively looks and listens, but if there is no serious problem or error, he should not interfere. This way, students will not be tempted to report to the teacher every time, and they will complete the task themselves, using the language as much as possible. Even if they ask for the teacher's help, he must do it quickly and efficiently, and then return to the observer position.

The communicative method uses different methods of teaching students. On the one hand, it is part of a limited practice, and on the other hand, it is part of a free practice. When talking about a limited task, we refer to exercises (written or oral) that focus on specific language topics or grammatical problems. For example, we can use the "fill in the blanks" writing exercise to help students learn new vocabulary or new grammatical elements. At the same time, an oral exercise may have as its main purpose the memorization of words used in certain communicative situations (for example, booking a hotel room, participating in an interview for a certain job or position in a company). These activities are usually easier because they limit students ' choice of certain topics. As for free practice, this is a type of activity in which the student must have the ability to maintain conversation and logical thinking. As a rule, this is a communicative activity that requires the student to be able to conduct a dialogue, answer and ask questions. This is the truth of a communicative goal, a method

that is more appropriate than those that require students to perform exercises according to a fixed pattern, in which there is no imagination and no need to speak, challenge, and therefore no improvement, progress. Complex conversational skills - both fluency and accuracy-are ultimately the goal of the communication method, as it focuses on the student and their language needs, meeting the clear goals set by the teacher after analyzing the student's needs.

Communication exercises require students to be aware of the relationship between form, meaning, and use. In communication exercises, students test and develop their ability to use language to convey ideas and information.

The main components of interactive lessons are interactive exercises and tasks that are performed by students. An important difference between interactive exercises and tasks from the usual ones is that by performing them, students not only and not so much consolidate the already learned material, but learn new ones.

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METHODOLOGICAL ASPECTS OF STATISTICAL ANALYSIS OF THE DIGITAL ECONOMY IN UZBEKISTAN

Abstract: *This article proves that at present the formation of the digital economy has a complex impact on the development of industries and spheres of the economic system of Uzbekistan. In addition, an important task for the further socio-economic development of Uzbekistan within the framework of digitalization and the transition to an information society is to improve the quality of information interaction in various spheres of society, in connection with which issues related to the statistical assessment of the development of e-commerce, the definition of processes occurring in it as a subject of statistical research and the development of a system of statistical indicators become relevant.*

Key words: *digitalization of the economy, e-commerce, innovative technologies, integration of digital technologies, statistical assessment, knowledge economy, institutional infrastructure, interactive electronic services, statistical observation.*

Language: *English*

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Introduction

The digitalization of the economy transforms the ways of delivery and consumption of goods and services, which in turn affects all spheres of human activity. The field of e-commerce is a relatively young area of statistical observation, so researchers, business representatives and other stakeholders currently lack statistical information, which, in turn, helps to study the economic, social and environmental consequences of the digitized world.

At present, experts agree that the current state of the economy represents a qualitatively new level of development of the public economy, in which the role of economic entities, the structure of the world economy, the essence of trade relations and public administration are changing [1]. Some experts call such a formation of the economy "post-industrial", "new", "innovative". They also resort to such names as the economy of knowledge, competencies, and network interaction. In recent years, the term "digital economy "has become more widely used in the scientific, government and business environment.

The distinctive features of the digital economy include improving the efficiency of economic processes, changing the structure of employment, redistributing the economic influence of countries on

the world market, and developing digital payment systems and electronic money. Along with the listed terms, the following also appear in the literature: "new technological way", "application economy", "creative economy".

The first works in the field of digital economy date back to the 90s of the last century. Many experts believe that the origin of the concept of digital economy is D. Tapscott, who in his book "Digital Economy" (1996) first described the system of a virtual economic system and described the essence of this phenomenon [2]. Other researchers as the primary source of the ideology of the digital economy call N. Negroponte, an American computer scientist, who in 1995 identified the main property of the economy of the new format-the virtuality of economic relations, electronic commerce.

Artificial intelligence technologies "provides that in accordance with the Strategy" Digital Uzbekistan – 2030" and in order to create favorable conditions for the accelerated introduction of artificial intelligence technologies and their wide application in the country, to ensure the availability and high quality of digital data, to train qualified personnel in this area, to approve a program of measures for the study and implementation of artificial intelligence technologies in 2021-2022 years, as well as a list of pilot projects for the introduction of artificial intelligence technologies implemented in 2021-2022 years, including with the involvement of residents of the Technological Park of Software Products and information Technologies [3-9].

The term "big data" is not new, but it began to acquire its true meaning only in the last few years, when technologies such as the Internet of Things, cloud services, peripheral computing and a number of others began to develop rapidly. They are the ones that contribute to the spasmodic growth of the data volume. Even a decade ago, this was considered a serious problem, but now organizations that experiment and implement machine learning (ML) and other types of artificial intelligence (AI) see big data as a boon for business.

AI and ML provide new opportunities to rediscover the value of big data, as well as to find new applications in view of the emergence of new types of data. Now we have much more useful data in the form of images, videos, and voice, for example. In the past, we tried to minimize the amount of this type of data we collected, because we didn't know how to get the most out of it, and it was expensive to store it.

There is a direct relationship between big data and AI: the latter is largely dependent on the success of the former technology, and it also helps organizations unlock the potential of their stored data through tools that were previously either very cumbersome or did not exist in principle. Today, we want to get as much data as possible, which is useful not only for better understanding of business problems, but also because the more data we enter into machine learning models, the better they become.

Despite significant progress, big data technology and analytics have not gotten rid of storage problems and a number of other complexities. In some cases, the combination of big data and AI creates new needs (or highlights existing ones), such as infrastructure, data preparation, and management, while in others it can be a key tool for solving an organization's operational problems.

Below are the main areas where the best ideas are fueled [10-18].

1. Creates new methods of data analysis. One of the fundamental business problems of big data boils down to a simple question: what should I do with them? What value can be obtained from the accumulation of huge amounts of information that the company already has and which will continue to be replenished in the future? As you know, it has always taken a lot of manual labor to extract value from data, but with the advent of AI and ML, this task will become easier.

Historically, when analyzing data, engineers had to use queries or SQL (query lists). But as the importance of data continues to grow, there are many ways to get a better understanding of it. AI is the next step in the development of SQL, what used to be statistical models have now merged with computer science and become AI and ML.

2. Data analytics becomes less time-consuming. The advent of machine models significantly reduced the number of time-consuming manual processes that were required to manage and analyze data. Thanks to them, data processing time that took days or weeks (or longer) has been reduced to hours, but people still play a vital role. AI and ML are tools that help companies analyze their data faster and more efficiently than only employees can do. In other words, AI encourages ideas and speeds up decision-making. Moreover, IT professionals can act in a similar way, using AI to reduce time-consuming manual procedures and speed up the maintenance of an organization's internal infrastructure. The nature of data analysis requires that it be performed in real time. Taking into account the fact that data is widely distributed across different data centers, regions, and clouds, companies are forced to move away from traditional methods of data management and analysis. The arrival of AI changes the rules of the game. Gone are the days when data engineers manually copied them multiple times, providing data sets to analysts' weeks after they requested them.

3. People still play an important role. Like other emerging technologies, AI and ML are critical to helping businesses build a more holistic view of the data world around them, enabling them to make connections between key data sets. Businesses need to combine the power of human intuition with AI to expand its capabilities. After all, in order to function

and fulfill its mission, an AI system must learn from the data that comes from humans.

Companies that successfully combine human and technology capabilities can expand access to key analytical data without the help of data scientists and business analysts, saving time and reducing the potential bias that can arise from the interpretation of data by business users. This leads to more efficient business operations, faster data understanding, and ultimately, improved enterprise productivity.

4. AI/ML will smooth out common data problems. Technologies change, and new ones appear from year to year, but one thing remains the same: the value of data is inextricably linked to its quality. Low quality means low value or no value at all. This is what combines big data with AI. "Every conversation about machine learning always comes back to the quality of the company's data. If the data is "dirty", the conclusions obtained from it cannot be trusted. Data cleaning has always been a stumbling block for analytical calculations, but perhaps a solution will soon come. The data for the ML can be cleared using the ML himself. DOD algorithms can detect extraneous and missing values, find duplicate records that describe the same object with slightly different terminology, normalize data for common terminology, and so on.

5. Analytics become more predictive and prescriptive. Big data analytics is the process of analyzing large and complex data sources to identify trends, customer behaviors, and market preferences, which help you, make better business decisions. The complexity of big data analysis requires new analytical tools, such as predictive analytics, machine learning, streaming analytics, and techniques such as in-database and in-cluster analysis.

In the past, data analytics was based on events that had already passed ("what happened"), and forecasts for the future were made based on historical data. AI and ML are opening up a new front: "What's going to happen" (or at least "what's likely to happen"). Moreover, the ML algorithm can be taught to make decisions or take actions based on predictive information. Today, and moves big data-related solutions to points precisely located on the timeline, using predictive analytics. These decisions were usually based on data that was obtained in the past and present, which usually led to a linear return on investment. The decisions made with AI input have taken on epic and exponential proportions. Prescriptive analytics is based on and has the potential to bring data-driven insights into company-wide strategies that drive business development.

To date, approaches to the statistical assessment of the development of the digital economy have already been formed. The objects of research of information society statistics are the Internet penetration, the parameters of the development of technological infrastructure and access to it, the intensity of the use of information and communication technologies (ICTs), human capital, the direct and indirect impact of the Internet on the economy and social sphere [19-20].

As a tool for assessing the state of digitalization in the world, the DESI (Digital Economy and Society) index takes into account 5 main groups of indicators: telecommunications, human capital, the use of Internet networks, the integration of digital technologies, and digital public services. Along with this index, there is the ICT Development Index (IDI), which is an integral indicator that includes 11 indicators that characterize access to ICT, the use of ICT and practical skills in the field of ICT.

Some experts depart from the already traditional approaches to measuring the development of the information society and consider the Internet economy as an object of statistical analysis, describing the methodology for calculating the contribution of the Internet to the economy, classification of economic activities of the Internet economy, sources of information for data collection. The calculation of the direct impact of the Internet is based on the system of national accounts and methods for calculating the gross domestic product [3]. They argue that in the conditions of modern society, a significant role in the development of e-commerce is played by the state, which sets the vector for the development of certain industries and coordinates the integration of certain technologies into these industries, develops a regulatory system of new economic relations, and also performs statistical monitoring of digital objects.

The formation of the digital economy on an international scale has a complex impact on the development of industries and spheres of the world economic system, including in the Republic of Uzbekistan. In the modern period in the statistical industry of the Republic of Uzbekistan, a large number of statistical calculations and forecasts are carried out on the basis of the use of advanced ICT, there is experience in organizing interaction between information systems (IS) operating in the State Committee of the Republic of Uzbekistan on Statistics.

An analysis of the main indicators of the development of the ICT sector in the Republic of Uzbekistan over the past three years shows that every year there is an increase in the number of interactive services, software is being developed\, communication and information services are being improved. As practice shows, the development of digital technologies contributes to the growth of the efficiency of the functioning of industries and spheres of the national economy.

Data from the State Statistics Committee of the Republic of Uzbekistan show that in the first nine months of 2020 year, the share of communication and information services in the total volume of market

services increased compared to the same period in 2019 year and amounted to 6.0% [5].

At the same time, it should be noted that the digitalization of the national economy requires new approaches to the integration of information systems of various departments in a single information space using a corporate portal. Through the corporate portal, the work of special web services recently developed in the State Committee of the Republic of Uzbekistan on Statistics is carried out.

For example, such as the Web service "Permanent population". This service informs the site visitors about the current population registration in the online mode. At the same time, taking into account the requests of the subjects of the national economy, a web service "Electronic Store" has been developed, which allows any economic entity to purchase the necessary statistical collection using advanced ICT.

Technologies for working with web services are built on the principle of openness, transparency and integration of information systems in order to provide high-quality information services to any user who has the skills to work with a website and the Internet.

Special sections on the corporate portal of the State Committee of the Republic of Uzbekistan on Statistics are devoted to Open Data, the upcoming population census in 2022 year, the Sustainable Development Goals, a multi-indicator cluster survey in the Republic of Uzbekistan in 2020-2021 years, etc. According to statistics, new information systems have been developed and are being put into operation in the Republic of Uzbekistan. Thus, the information system "Consumer Price Index Calculator" has been developed to calculate the overall change in the consumer price index (CPI) for a certain period of time and is designed to operate online. The following system, which developed and implemented in the State Committee of the Republic of Uzbekistan on Statistics in a pilot version is an information system based on the use of observation tracking technology using tablets - CAPI technology (Computer Assisted Personal Interviewing).

It is also symbolic that 2020 year in the Republic of Uzbekistan has been declared the Year of the Development of Science, Education and the Digital Economy. The state program, adopted within the framework of the Year of Development of Science, Education and the Digital Economy, provides for the implementation in the current year of the large-scale tasks designated by the head of the republic. Today information and communication technologies occupy an important place in the development of the republic. The work carried out in previous years by the leadership of the Republic of Uzbekistan on the widespread introduction and development of information and communication technologies is already bearing fruit. If we turn to economic indicators, then 2019 year can be characterized as positive. The total volume of provided ICT services

reached 104 percent. The volume of services in the field of communications and informatization increased to 130%. In addition, the following other important indicators can be cited

The volume of computer and software services in 2019 year increased by 119%;

• Exports of software products and services grew to $15.8 million, or 158% (according to the plan is $10 million);

• The amount of remuneration in the field of information and communication technologies also increased significantly.

• The number of enterprises with the participation of foreign capital is also consistently growing: at the end of 2019 year, their number amounted to 269 units (increased by 73 units). In 2019 year, the Ministry implemented 9 large projects totaling $177.5 million in accordance with the projects included in the Investment Program. Moreover, the plan was over fulfilled by 102% (according to the plan - $174.02 million). In particular:

• Based on direct foreign investments - projects worth $97.14 million (according to the plan - $94.5 million, growth dynamics – 103%);

• On the basis of foreign loans secured by the state - projects in the amount of $53.38 million (according to the plan - $43.56 million, growth dynamics – 123%.

At the expense of the enterprises' own funds - projects worth $26.93 million (according to the plan - $35.96 million, the volume was fulfilled by 75%). In the 2019 year, work was done in the ICT field in a number of important areas. By registering websites in the national segment of the Internet under the "UZ" domain, work has been established to provide beneficial services for consumers receive knowledge by young people online and provide services to the population through electronic services. Also, fruitful work was done in the field of online payment: for example, in 2019 year, 299.3 million transactions were carried out through online payment systems. In order to develop contactless forms of communication between the population and entrepreneurs, on the one hand, and government agencies, on the other hand, a new version of the Unified Interactive Portal of Public Services was developed. Today, 176 types of electronic state services are provided through the Single Portal 15.1 million applications have been received. This, in turn, makes it possible to significantly reduce the costs and time of the population. More than 4.4 thousand state bodies and organizations and over 30 thousand users are currently connected to the Unified Interdepartmental Electronic System of Performing Discipline.

In 2019 year, work was also carried out to develop the telecommunications infrastructure. Thus, the total bandwidth in the international Internet network reached 1.200 Gbit/s, and through the switching centers the speed reached 750 Gbit/s. Thus,

the download throughput increased by 76.6%. And since January 1, 2020 year, tariffs for operators and providers for Internet services have been reduced by 34%, the number of Internet users has grown to 22 million, including 19 million mobile Internet users. Backbone telecommunications were expanded at 237 objects across the republic, telecommunications equipment was modernized.

Thus, the throughput of backbone telecommunications in the regions is 200 Gbit/s, in the regions is 40 Gbit/s. Also, during the implementation of the project for the construction of fiber-optic communication lines 10.0 thousand kilometers of fiber-optic lines were erected, and thus their total length is 36.6 thousand kilometers. With the aim of developing mobile communication networks, 2.017 mobile base stations were installed. Thus, their total number exceeded 26 thousand, and the coverage of the population with mobile communications reached 96%, and the level of coverage with broadband communications to the mobile Internet network reached 70%. In the course of the implementation of work on expanding the coverage of connection to broadband communications by operators and providers, 786 thousand ports were installed, and thus the total number of ports for connecting to broadband Internet reached 1.9 million pieces.

In order to increase the attractiveness of service, tourism, trade and catering facilities by business entities, telecommunications operators and providers in public places, places of pilgrimage, railway stations, airports, tourist sites, as well as at all facilities of the Tashkent metro, over 685 thousand Wi-Fi points have been installed. The emergence of digital technologies is closely related to the emergence of a huge number of different sources of information. The data generated by the digital economy, in terms of their scale, variety, nature of occurrence and complexity, require adequate statistical accounting. However, at the moment, international statistical organizations recognize the inability of the modern statistical apparatus to describe all the visible and expected consequences of the transformation of society. In this case, the current model of the functioning of official statistics as a type of state activity, such as lawmaking, lags significantly behind the actual trends. The underdevelopment of statistics acts as a barrier to the development of the digital economy. This is due to the fact that all interested parties cannot get an adequate picture of what is happening, which, as you know, has a negative effect on further development.

But in contrast to this opinion, a number of objective arguments should be made in favor of the fact that international statistical organizations are making every possible effort at the moment in order to adapt the system of statistical indicators to adequately reflect the current situation. First, the theoretical framework and methodology of information society statistics - the forerunner of digital economy statistics - is a well-developed tool for reflecting trends in modern processes. Secondly, within the conceptual framework of the current model of statistical observation, it is already possible to collect data on new digital phenomena. Third, the adaptation of the statistical infrastructure - a critical element in the development of statistical accounting for the impact of the new economic system - is on the agenda not only of many international statistical organizations, but also of national statistical offices.

The latter factor, in turn, is an important tool for national statistical organizations to generate meaningful statistics that will help policymakers, businesses and the public assess the impact that digitalization has on the economy and society as a whole. Based on the review of the definitions of the digital economy, we can conclude that the term "digital economy" is put forward primarily in order to try to cover the issues and problems that have arisen in the field of interaction and exchange of goods and services between consumers and producers in the market of goods and services. Although the term has gained popularity, no definition has yet been proposed that demonstrates the true role of what is meant by the digital economy. It is unclear whether such a definition will ever be proposed, in part because the phenomena of the digital economy are pervasive - it is not so much a part or a sector or a branch of the economy, but a transformation of the entire economic system and, as a consequence, of public life. Accordingly, it is more appropriate to refer to the "digital model of the economy" rather than the "digital economy". Electronic commerce, in turn, includes trade and financial transactions carried out through electronic networks.

E-commerce is one of the most powerful engines for technology development and international business. There is no doubt that the conditions created by the digital economy are transformative. These changes are in the way a product or service is produced, delivered and consumed in an increasingly digital marketplace. The very essence of e-commerce contributes to the reduction of distances, as it blurs the boundaries and helps to establish connections between anywhere in the world. At the same time, issues of intercultural communication, culture of information consumption, business principles in different countries remain open and will always be relevant. Building a business over the Internet requires well-designed and effective privacy solutions. One way is to use certification, access authorization. Thanks to new technologies, innovations and social trends, the digitalization of the economy is changing the behavior model of economic agents. While end products have not changed much, digital technology and new business models are changing the way we deliver and consumer goods and services.

At the same time, it is important to emphasize that in reality only the behavior model of market participants is changing, while economic benefits by themselves do not change their essence. The term "analog", which is common in popular literature, is appropriate here, as opposed to the term "digital". Most of the new innovative products remain "analog", and the emergence of "digital" services is a normal process of market development. Hence, it is important to emphasize that the main task of statistics is to describe the qualitative changes taking place both in the economy and in society. And if such a role of statistics has always been assigned to it throughout its centuries-old history, then in the modern world this task is becoming much more difficult to solve. First of all, due to the fact that many socio-economic sciences, faced with the new digital world, are unable to describe some new phenomena and form a point of view on the facts of digital transformation. There is undoubtedly tremendous value in entirely new data, as evidenced by the emergence of new products and services, as well as the growing concern of policymakers about the impact that digitalization is having on society.

As more and more businesses in various industries use new digital technologies, the economy is becoming more digitalized. Online shopping and e-commerce are the main channels for consumption, and the products themselves are moving from physical media (CDs, videos, books) to digital ones. With the proliferation of digital end-to-end platforms, the participants in online transactions are also changing. Whereas previously there were two main actors in any transaction, online transactions increasingly involve multiple actors: the entity that processes payments between buyers and sellers, the entity that distributes final products, and so on. We can say that the main distinguishing feature of the digital economy is the widespread penetration of information and communication technologies in the economic sector, the public sphere and public administration. Experts agree that the task of successful development of the digital economy belongs to the state, which is assigned the role of coordinator for the introduction of advanced technologies. At the moment, many countries are concentrating their efforts on state regulation of the development of the digital economy

and e-commerce. According to various estimates, the leaders in the development of the digital economy in the world are China, the United States, the United Kingdom, South Korea, Denmark, the Netherlands, Sweden, Norway, Germany and Japan. Despite the initiation of state strategies for the development of the digital economy in Uzbekistan, the preconditions for the transition to a new format economy have not yet been fully formed. Lack of institutional infrastructure, significant digital inequality, insufficient level of information security, shortcomings in the system of training qualified personnel are highlighted among the main barriers preventing the development of the digital economy in the Republic of Uzbekistan. At the moment, the task of determining specific steps to accelerate the digitalization of society remains relevant - which technologies and how should be applied, what are the factors for the effective development of the digital sphere and the sphere of e-commerce, to what extent the development of the digital economy spheres in the Republic is ensured. For the effective development of e-commerce, the following main factors can be indicated: the development of ICT infrastructure, interactive communities, information resources, knowledge bases, digital environment, new forms of electronic interaction, and platforms for integrating business, government and society.

For the successful development of the digital economy in the Republic of Uzbekistan within the framework of the state strategy "Digital Uzbekistan - 2030" it is necessary to ensure: the development of state, socially significant online services; transition to digital technologies of state bodies and departments; the development of the Internet of Things in the consumer sector and in industry; creation of domestic software, modern ICT for the purpose of import substitution. At the same time, it should be emphasized that at the moment these tasks are partially being solved, however, their final implementation is possible only after determining the sectors of the economy for the implementation of individual digital solutions and the development of target indicators characterizing the effectiveness of the implementation of the selected technologies in certain industries.

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MODEL OF INFORMATION AND ANALYTICAL SUPPORT SYSTEM FOR FIRE SAFETY MANAGEMENT OF EDUCATIONAL COMPLEXES MAJOR CITIES AND AGGLOMERATES

Abstract: *The design of a fire safety system for educational complexes with centralized management differs significantly from that for an educational institution. The article proposes a model of fire safety management support system for educational complexes that combine geographically distributed objects of different levels of complexity.*
Key words: *modeling, management, educational complexes, fire safety.*
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Scopus ASCC: 1710.

Introduction

In the last decade, the total consolidation of existing organizational management schemes for organizations of different levels and profiles has achieved both positive and negative results. Many key classical control schemes, such as direct and reverse target trees, *CRM* or *BPMS*-systems can no longer always cover the necessary internal and external processes as a single management environment [8, p. 131]. A way out of this situation is often offered in practice combined options. At the same time, it is always specified that the resulting scenario will have a strictly limited functionality, simulate a strictly defined profile or selected environment.

For example, the educational environment of the Russian Federation (as a management system of a state Corporation) has been constantly modified and changed not only organizationally, but also structurally since 2002. The key point of departure in a new form-stage management system of the training was to transition from fragmented forms of governance each level independently, to the system of management of educational systems, including the educational structure of Junior, middle and secondary levels as a single management body [9, p. 3]. Further, only this control object will be considered from the point of view of a relatively new task – fire safety

management of geographically distributed control objects (partially Autonomous) with a single remote control center.

The problematic component is that persons responsible for fire safety at management facilities, according to new Federal regulations, are forced to necessarily coordinate their own decisions (as local coordinating units) with the actions of external specialists of this profile (for example, with the territorial heads of the guard duty shifts of the Ministry for Emergency Situations), using available tools and methods. This scenario is not always possible due to a number of circumstances, which is due to many factors that are not predetermined in advance. For example, an administrative unit (local Director) of an educational structure should use preventive measures to localize an emergency on its own (if possible). However, only the main subject of management (the Director of the entire educational complex) know the resources available and the possible interaction between them, not only the educational structure, but also neighboring objects of the educational complex that even in the early stages of the elimination raises a number of delays related to the organization of interaction online.

It is proposed to comprehensively consider the model of system support in the management of fire

safety of geographically distributed objects, allowing to consider the factors: model scenarios of fires managed objects, standalone technical component, beginning with procurement and ending with processes of reconciliation of key components,

centralized support system of resource management in coordination with external regulatory bodies (e.g. the Ministry for Emergency Situations (the Ministry)), (pic. 1).
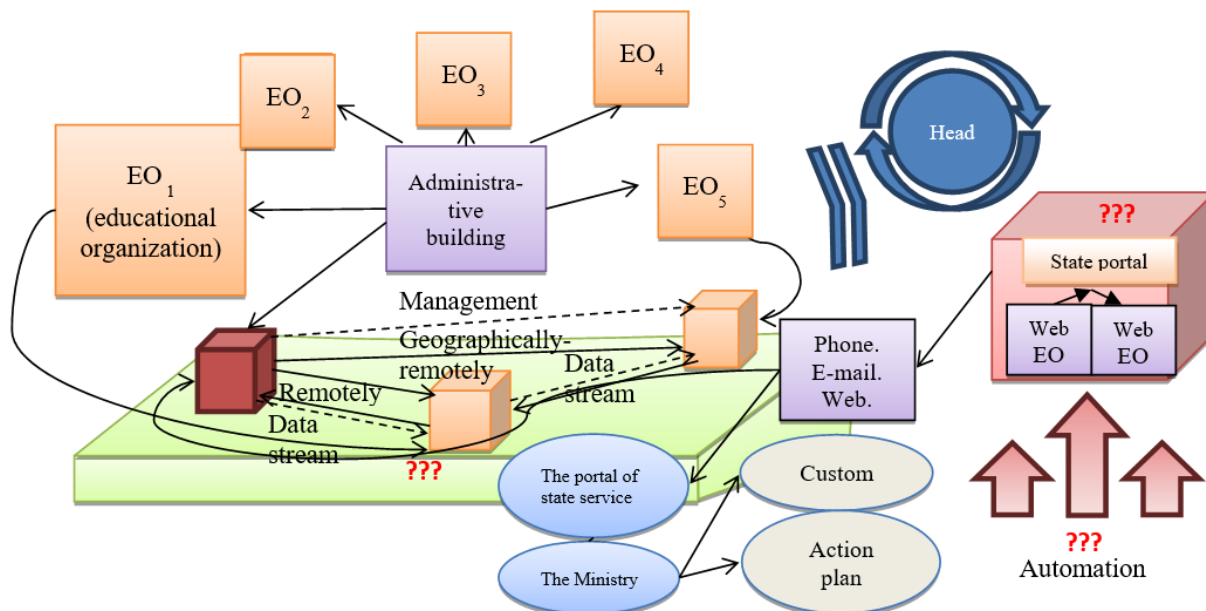
Picture - 1. Structural diagram of the model of fire safety management support system in buildings of the educational complex

At the first stage of research, typical scenarios for the protection of existing educational complexes were analyzed. It was revealed that at the management stages in case of an emergency, the actions of the responsible personnel differed significantly from similar actions of the personnel at neighboring facilities, which caused many problems. As a result, fire safety systems also performed their functions differently. As a result, the stages of typical scenarios for the development of fires in educational complexes have been worked out. For example:

− in the case of smoke in the room in the basement of the building, the system will work according to the classic scenario "ATTENTION" and "FIRE" with the launch of the control system for the engineering complex of the object;

− in case of a fire on one of the floors, the facility's engineering complex will be launched, warning and evacuation systems will be launched in case of a fire, and smoke removal transoms will be opened [4, p. 4; 5, p. 3].

The developed scenarios take into account that in case of emergencies and fires at management facilities, different scenarios for the development of dangerous situations are possible. As the primary factors may be the smoke, and open burning, and leakage of flammable liquids, etc. in any development personal staff, administration and engineering

complex object should work as a single mechanism, following a clear algorithm of actions [3, p. 5].

Moreover, the developed scenarios allow achieving the following non-core results:

− identify the most dangerous areas (required for the development of special technical conditions, the formation of schemes, plans, etc.);

− preidentify the shortcomings of fire protection systems, fire suppression, evacuation of people;

− assess the adequacy of fire safety measures;

− to identify previously undiscovered hazards;

− check the effectiveness of additional security features [2, p. 2].

In addition to the main research of the subject area, the analysis of existing models is carried out. It is revealed that many programs have already been developed that allow creating models of fires mainly in the field mode. More than 150 models of fire development have been registered. However, for this area of research, models should include: features of evacuation of people (taking into account social affiliation); features of using modern means of Autonomous fire protection as a single system.

At the second stage, for a detailed study of the initial data (using the Kaoru Ishikawa diagram [1, p. 4]), the factors, causes and consequences of emergencies and fires were studied using examples of buildings of educational complexes (pic. 2).
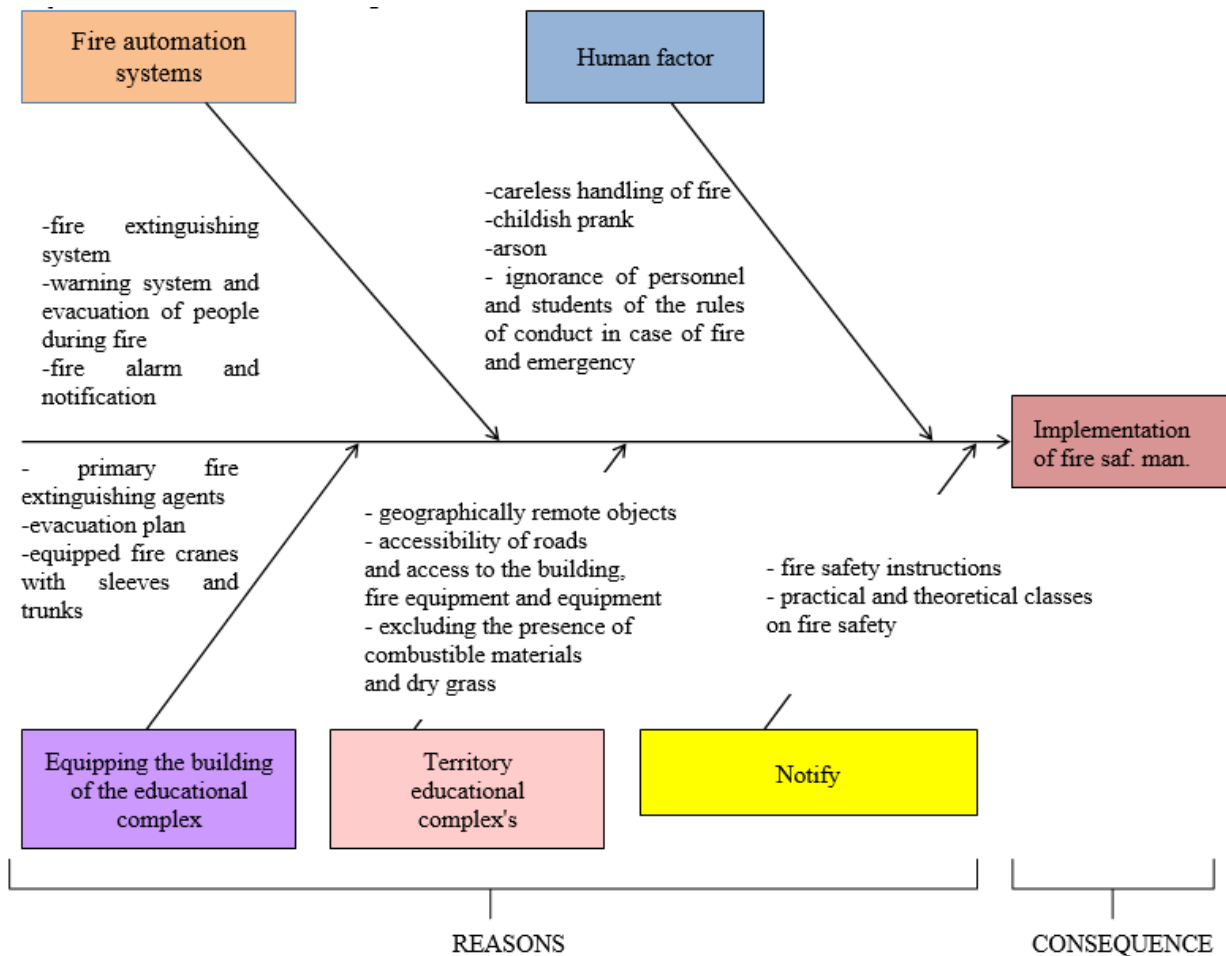
Picture - 2. Factors, causes and consequences of emergencies and fires in buildings of educational complexes

The key factors that need to be taken into account when modeling fire safety management processes are highlighted:

− irresponsible attitude to the performance of technical fire safety systems on the part of the service organization and duty personnel, which often leads to the failure of the system of the entire engineering complex of the object;

− the use of resources of buildings and structures of the complex is possible only when using the instructions of the main management;

− only the head of the educational complex makes key decisions in case of emergency situations and fires.

The main factors that may cause emergencies or fires on the territory of the complexes are analyzed.

Let's consider one factor scenario based on the above scheme (the primary cause of the fire is a person). Necessary:

1. *Ensuring compliance with fire safety requirements in the educational complex*: compliance with fire safety requirements in the field, maintenance of primary fire extinguishing equipment in working order, availability of individual protective equipment and first aid kits for medical care.

2. *Message about a fire*. The most typical factors are: the wrong choice of the GSM network operator, through which the signal is transmitted to the crisis management center of the subject of the Russian Federation.

3. *Termination of all work in the building*. Irresponsible attitude to reporting an emergency or fire, as staff are often "used" to believing that such reports may be false or educational. Incorrect configuration of the notification rack that transmits broadcast signals.

4. *The organization of the evacuation*. Irresponsible attitude to the condition of the complex: closing of evacuation exits, cluttering of stairwells, narrowing of evacuation exits and escape routes; smoke may occur due to the fact that there is no or does not perform its function of the smoke removal system, and the presence of strong smoke indicates a fire load.

5. *Organizing a meeting of fire departments*. The presence of foreign cars at the entrances to the territory of the educational complex, the presence of blocked entrance groups on the territory. The fire

safety officer who meets the fire departments is not aware of the presence and number of victims and the location of the fire in the building, as well as not knowing the layout of the building of the educational complex.

At the next stage of research, modeling and systematization of the process of centralized procurement of resources necessary for ensuring fire safety of the entire educational complex as a whole on a competitive basis was performed. A game-theoretic model of the management support system has been constructed that allows to systematize the purchased resources in a single facet of these target projects, the possibility of implementing which is considered by the decision-maker (pic. 3).
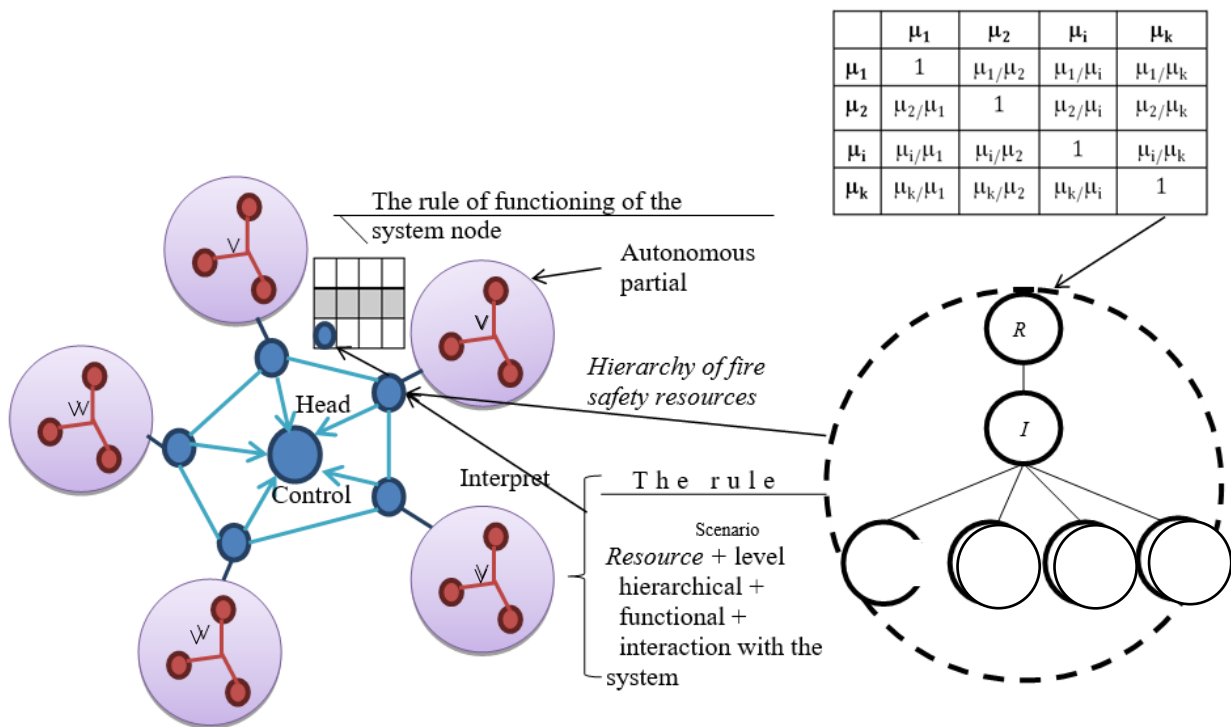
Picture - 3. Model of the process of selecting resources of the management support system by building a payment matrix and a tree of goals

The decision-making process is characterized by a payment matrix, a tuple of the form $\Gamma_R = <I, J, R>$, where [7, p. 123]:

$I = \{1; 2 \dots i; k\}$ – the set of strategies of the first player (the decision-makers (head) on resource selection);

$\tilde{I} = \{(\mu_1/1); (\mu_2/2); \dots (\mu_i/i); (\mu_k/k)\}$ – fuzzy set, μ_i – reliability level of the alternative i-th element's;

$J = \{1; 2 \dots j; n\}$ – a set of second-player strategies (those who make decisions about choosing suppliers in the controlling organization. For example, the Russian emergencies Ministry);

R – payoff matrix, $R = R_{k*n} = (r_{ij})$.

To select the most reliable resources, a game-theoretic model of comparative analysis of the reliability level is also built (pic. 4).

NPV (net present value)

IRR (internal rate of return)

PI (relative profitability of the company)

PP (the rate of return)

DPP (discount payback period)

Picture - 4. Game-theoretic model of comparative analysis of reliability level

The process of making management decisions for comparative analysis of the level of reliability is characterized by a tuple $\Gamma\mu = <I, J, \mu>$, where:

$I = \{1; 2 \dots i; k\}$ – many resources;

$\tilde{I} = \{(\mu_1/1); (\mu_2/2); \dots (\mu_i/i); (\mu_k/k)\}$ – a fuzzy set of resources with a given goal, μ_i – value of the i-th resource's ownership function;

$J = \{1; 2 \dots j; n\}$ – multiple scenarios;

μ – payoff matrix, $\mu = \mu_{k \times n} = (\mu_{ij})$.

The effectiveness of using suppliers' resources is assessed by a set of assessments. The system for evaluating the economic efficiency of resource use is based on a hierarchical model for calculating efficiency from the point of view of participants in the main process. The system takes into account the dynamics of financial flows arising in the implementation process, as well as incomplete information and uncertainty.

The most commonly used quantitative performance estimates are such indicators as net discounted income *NPV*, internal rate of return *IRR*, return index *PI*, payback period (period) without discounting *PP* and payback period with discounting *DPP* [6, p. 6]. The sequence diagram of the comparative analysis of resource reliability based on the combined application of games has the following form (pic. 5).

1. Creating a set of *I* all resources by the provider.

2. Generation by the supplier of a set of *J* all possible scenarios for implementing resources on objects.

3. Evaluation of resource efficiency for each new scenario based on calculated values of indicators (primarily *NPV, IRR, PI, PP, DPP*).

4. Evaluation of the values of μ_{ij} function of belonging of the *i-th* resource to the set of $\tilde{I}$ most reliable projects in the conditions of the *j-th* scenario.

5. The solution to a antagonistic games (AG), $\Gamma\mu = I, J, \mu$.

6. The calculation of the reliability levels of resources, assessments' μ_i^*, $i = \overline{1, k}$, values of the resource set membership function $\tilde{I}$.
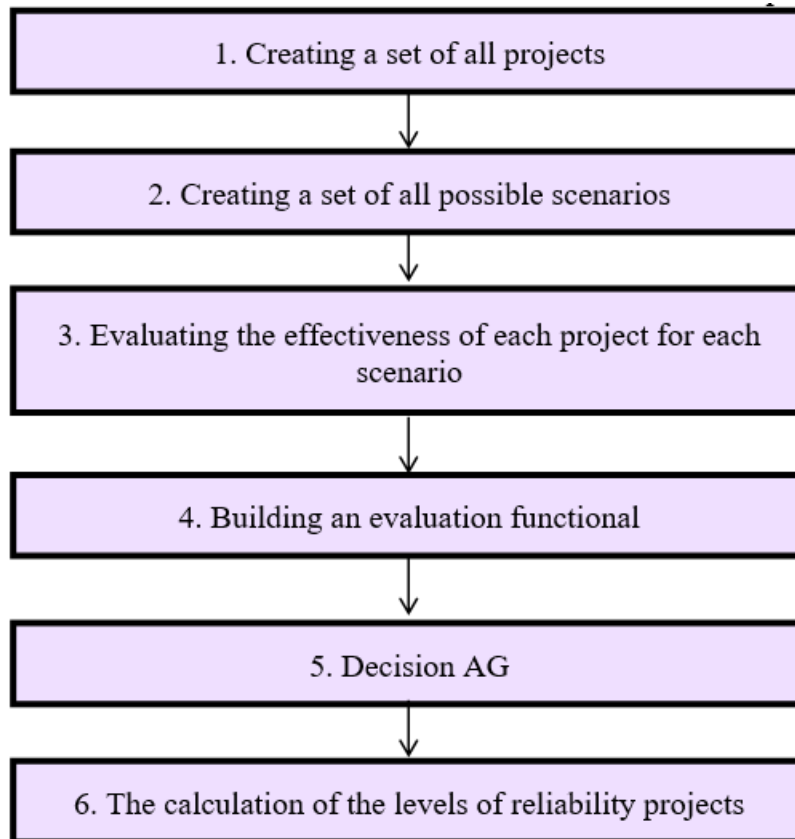
Picture - 5. Scheme of comparative analysis of the level of resource reliability

Based on the formalization, the algorithm of interaction between the decision-maker from the educational complexes for selecting resources and the decision-maker from the controlling organization (the Ministry of emergency situations of Russia (Emercom)) when selecting suppliers is constructed (pic. 6).
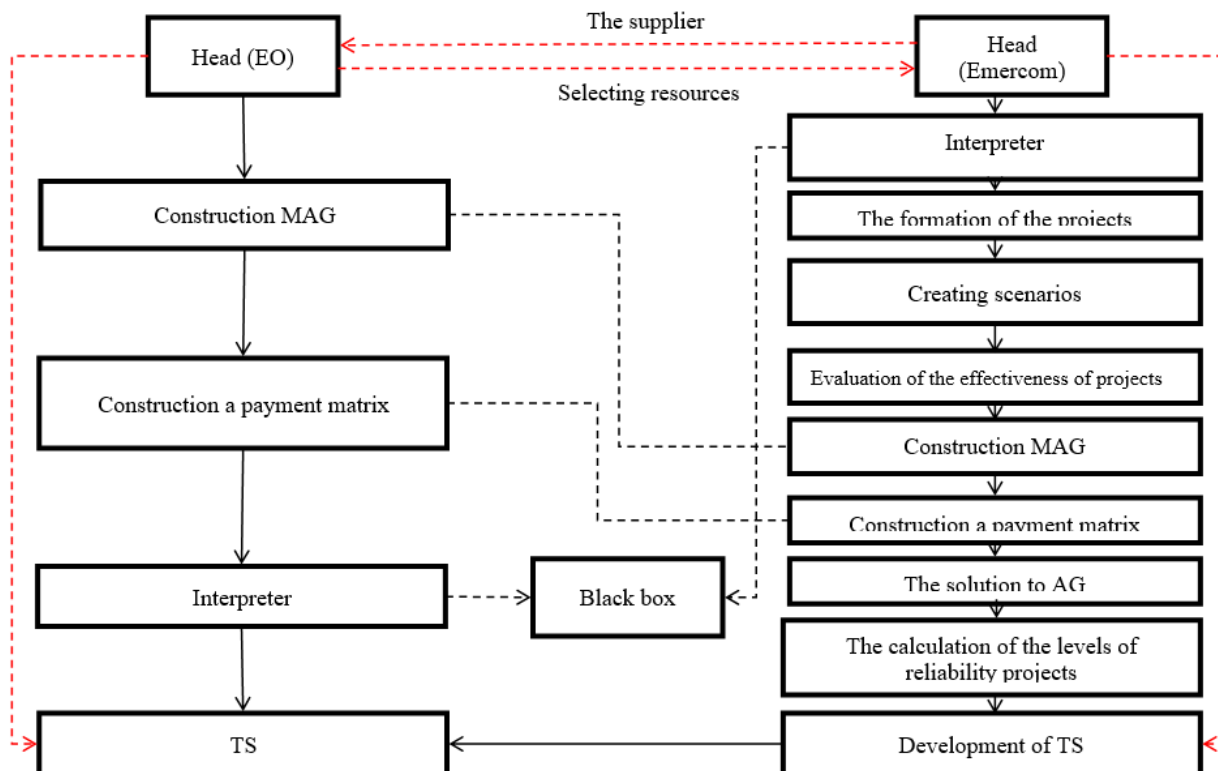
Picture - 6. Scheme of the algorithm for interaction of decision-makers

To build a conceptual model of transition to a software-algorithmic form of information representation, a model of interaction of data flows in a single information-analytical system using the "black box" method is constructed [9, p. 5].

Modeling the situation on socially important objects in the event of an emergency or fire is important due to a variety of negative factors both at the time of occurrence and when analyzing the consequences. The use of modern information systems and technologies with the use of specialized software systematized in the form of a single information space for educational complexes allows for the most effective fire prevention, localization, elimination, and extinguishing. It is also necessary to take into account that the negativity of these factors can be avoided by a comprehensive analysis, starting from the first stages of resource implementation (for example, the procurement stage) [10, p. 5]. The paper presents the decision-making process using the game-theoretic scheme of comparative analysis of resources based on the combined application of games. The presented model for the selection and distribution of resources is an effective means of solving many problems in ensuring fire safety in the process of functioning of educational complexes.

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TRENDS IN THE TRANSFORMATION OF ART THROUGH SOCIAL MEDIA

Abstract: *This article focuses on the trend of transforming art through social media. It is important to develop online art forms through the ubiquitous development and integration of social media. The interaction of social media has a huge influence on artistic institutions and the way of population's lifestyle, and as media technology updates, the artistic experience and culture of participation will continue to change.*
Key words: *art transformation, social media, development, population's lifestyle, artistic experience, culture.*
Language: *English*
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Soi: http://s-o-i.org/1.1/TAS-03-95-14   *Doi*: crossref https://dx.doi.org/10.15863/TAS.2021.03.95.14
Scopus ASCC: 3300.

Introduction

The rapid penetration of social networks into all spheres of public life in Uzbekistan plays a transformative role in the paradigmatic changes in the way of population's lifestyle. It is important to develop online art forms through the ubiquitous development and integration of social media. As a result of acquaintance with works of art through social networks, mutual discussion, promotion and evaluation of works, there is a need for sociological research of interaction in social networks.

Nowadays, if the popularity of artwork is seen as a process that depends on its contemporary appearance and not on traditional art forms, the foundation is laid for the transition to social media environment in the context of globalization. The online art market has grown significantly over the past five years. In 2019, over 10% of art collectors bought any artwork online. In an informed society, the mental characteristics of national values are preserved due to the development of traditional Uzbek art, based on the traditions of generations' continuity.

Among emerging social media, Instagram has the highest performance, with 8% of art buyers using Instagram. In addition, relations between museums are strengthening, and relations between museums and public are becoming more interactive and collaborative. Social media is increasingly being used to directly create or plan art. According to the sociological survey of Uzbek migrants abroad on social networks, during the exhibition of their "favorite" paintings, 10% of the participants showed an increased interest in Uzbek art.

The expansion of human evolution thought in modern times, the main reason for social change is the development of media communication technologies.

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Before the Internet era, the value of art was determined by art critics. Today, Instagram remains an unconventional way to discover, promote, and critique art. Instagram entered social life as the aesthetic value of new global youth stratum that emerged in early 2010. The globalization and integration of online art practices leads to a cultural transformation of all types of art.

In our opinion, technologies are viewed as a means of cultural development, and the interaction and user orientation of these technologies leads to the "transmutation" of cultures. Its structure and use are disinfected with the help of online platforms, computers and smartphones, and online content is reconstructed and forms a "culture of participation" of young people in its reintegration.

Materials and Methods

A culture of participation is a form of informal patterning that has the potential for artistic expression and mobility in activating citizens, receives strong support to create and share its creativity, and is passed on from the most experienced people to beginners. It also leads to an irrational culture in which participants consider their contribution to be important in a culture of participation and form some degree of social relationship with each other. Interaction on social media happens very quickly, either as a novelty or as an instant result.

The artistic experience on social media is a big change in which the type of artwork is critical. According to experts, the media can influence participants on social networks through experiments, texts, or photographs, including dance, music, photography, modern traditions. However, ad hoc research on the relationship of artworks on social media is a new area of research with a limited number of published works, especially in the visual arts, which requires establishing and diversifying evaluations. To this end, we are analyzing quantitative and qualitative analyzes to examine the communication relationships between our favorite artworks, which have a correlative influence on traditions of continuity in art.

Instagram is redefining the way we do business in the art world. Instagram can be the most convenient time to explore interactive art online. The theoretical contribution of this study is to expand the study of interactive behavior of users of social networks in the art market, which is important in the development of social networks in mobile Uzbekistan to study the impact of artistic psychology and socio-marketing relations on the new generation. In addition, our analysis reveals important psychological aspects that go beyond fiction. For the first time, it is important to systematically conduct a sociological analysis of the impact of future popular art on Instagram and the formation of aesthetic consciousness and culture of people, considering their geographical characteristics.

The impact of digital technology on new media art has transformed traditional visual arts. Artworks created using modern media technologies, including digital art, computer graphics, computer animation, virtual art, internet art, interactive art, video games, computer robotics, 3D printing art, are considered biotechnologies.

Self-realization was originally introduced by Kurt Goldstein to realize its full potential [1]. Avrai Maslov believes that actualization is the driving force of human personality, it has reached five levels of motivation: physiological, safe, social, respect and self-awareness [2]. Maslow argues that human motivation is based on the achievement of personal development and the desire for change.

Ritter emphasized that interaction plays an important role on social media, noting that while form and content are extremely important to artistic creation, attention should also be paid to the way of artwork and a person communicate [3]. While digital technology has played a pivotal role in pushing the boundaries of art, social media has changed the spiritual attitude of society towards art. Digital interaction with the audience can stimulate cognitive decoding, and the lack of dynamic kinesthetic for artistic performance can improve the practitioner's emotional relationship [4].

In Manovich's book on Instagram, Instagram's image culture is embodied in a rich cultural and historical context, including photography, film, graphic design, as well as modern social media, design trends, music video, and k-pop history [5]. Manovich uses Instagram as a mirror of a younger global generation, linked by shared social media platforms, cultural sensitivity, and visual aesthetics. Social media portrays the landscape of art world, influencing not only marketing but also the fact that art creation aims to treat creative and dystrophic changes [6].

Social networks serve to meet the social relationships of people and meet the needs for mutual respect and self-awareness. Most sites help social media members interact based on shared interests, political views, or actions that inspire them to participate. Instagram users have five main social and psychological motives: social interaction, archiving, self-expression, avoidance, and search [7]. Self-expression is about achieving personal goals, presenting yourself with a consistent and positive outlook on the world, and adhering to social norms. In the hierarchy of needs in the online community, we believe that being able to understand oneself takes on social responsibility, develops skills, and creates new opportunities. People strive for self-expression, self-esteem, and self-awareness through participation in social media.

Today, social media remains a demanding area, requiring users to constantly update their contacts and ratings. According to a poll by the Pew Research Center, 34% of social media users admitted to using

social media for a "mental break," 27% used social media to keep in touch with their families, and 24% have established or maintained professional relationships [8].

The study of user generated content on social media reflects problems in many areas of society. When analyzing a collection of more than two hundred thousand photographs taken from the annual materials of national sites in Uzbekistan, visualization techniques were used to highlight cultural differences. In modern conditions of information globalization, people's leisure through social networks leads to certain changes in their national and cultural thinking and requires the creation of mechanisms for determining the correlation effect of the development laws of "socio-therapy". Currently, social networks can be an effective and socio-ideological mechanism for the phenomenon of cultural diffusion. Styles and trends in trend designation create the basis for visual discovery, analyzing clothing and fashion in the images of millions of people around the world. Having a strong, competitive media is more important than contracting with a leading agency or the aesthetic standards required by the industry.

When users post on social media, the content needs to be impressive, and a good way to gauge impact is by interacting with the comments. We have selected the number of likes, comments, posts, followers, and subscribers as a function that reflects the main aspects of communication on Instagram. We used quantitative and qualitative research methods to systematically examine the interactions between artists and social media followers. The first explores the characteristics and causes of the most popular artworks (X1, X2, X3 and X4), while the second explores the artist's views on interactions (X5 and X6).

Survey and Findings

We have handpicked 100 individual fine art accounts with over 1000 Instagram followers. The database we collect includes: 1) a social network containing profile information, photos, headers, and tags, as well as subscribers and subscribers of users; 2) biography; 3) posts (photo or video); 4) likes, comments, tags, etc.

When viewing Instagram pages of all users, their profile pictures, personal sites were considered. The gender, address of residence and art forms of the respondents were directly studied. The final database includes 1200 posts by 86 artists (42 men and 44 women), as well as the cost of comments, likes, subscribers, observers, and comments from 8 regions of Uzbekistan. We analyzed the work of 86 artists to find out which of artworks was the most popular. However, there are many methods of artistic classification that can be classified by media, content, or genre, with different websites or social media

platforms being classified differently. For example, the Wikiart Center divides artworks into 61 genre categories and 185 media categories [9]. Moreover, many sciences today are also integrating digital technologies, and the distinction between traditional artworks and new media created with the help of computers disappears.

An online survey was conducted to examine the influence of artists on public opinion with their work. 25 artists completed an Instagram survey (men 12, 60%; women 8, 40%) between the ages of 20 and 60. 51 artists – 0% of artists have been artists for over 15 years. Among these, 38% of participants were college graduates, 22% were graduate students, 10% were high school graduates, 21% were graduates of some colleges, and 9% were trade/vocational colleges. The respondent artists came from 8 regions of Uzbekistan, 31% from Tashkent, 17% from Samarkand region, 12% from Fergana region, 10% from Bukhara region, 8% from Surkhandarya region, 8% from Khorezm region, 6% from Syrdarya region, 8% from Andijan region [10].

During our research, we analyzed the content and text of the 10 most loved and most commented works in terms of quality to find out the characteristics of the most popular artworks. The results indicate that photographs of artists' faces and their work, or reports of the artist's work process in general, were more popular. A photo with a face attracts more likes and comments on Instagram. Facial attraction is based on universal (innate) sensory mechanisms and cultural influences. The perception mechanisms of attractiveness and face beauty in artworks follow a similar ontogenetic pattern. Apparently, the attractiveness of face for the choice of spouses is just as important as the human body beauty. Faces are powerful channels for non-verbal communication. Faces provide vital information about a variety of touching contexts such as attractiveness, emotional complexity, uniqueness, age, humor, and person's regional and national origins. Although gender issues were also seen as influencing the use of social media, the artists did not demonstrate their attractiveness. Top 5 posts include tutorials, images, artist lives, or hilarious laughs. Some of the most common comments were: What is this?; I love; Large; "Akl-idrok"; The most common reasons for commenting are curiosity, questions, and confirmation.

Based on the research results, we analyze in detail the most liked and most commented artworks, respectively, by titles, comments, and text content of posts.

The clear common denominator of the top 10 most commented posts, according to research, sparked controversy. Famous artists who continue to share their new artwork and creative activities on Instagram are making their creativity effective.

We analyzed the four supernatural values of our analysis and noted the growing status of likes and

comments, as well as some similarities in these popular posts, including sharing guidelines, listening to status, interesting or funny illustrations, empathy, asking questions, interest, and celebrity. They can be divided into categories:

- ➢ Data exchange.
- ➢ Ask the question: "What do you think?".
- ➢ Curiosity: "What is this?".
- ➢ Interesting or funny illustration.
- ➢ Compassion.

In-depth exchange of views and interaction through questions to Instagram members or showcasing their creative and personal lives will define the overall character of their favorite and most commented artworks. Participants feel like artist friends and participate in the life and the artist work. Social media engagement is a culture in which group members value their contribution and increase their value and potential by interacting with artists to grow together. Traditional artistic experience is passively and didactically interpreted by experts or organizations. Social media is shaping new artistic experiences on the Internet by allowing real-time communication between artists and participants to customize any artwork at any time in an interactive process. Participants unknowingly engage in art selection based on favorites and comments.

It is well known that intuitive thinking plays an important role in human self-expression. The driving force behind social mobility has reached five levels of motivation, reflecting the idea of self-awareness: physiological, safe, social, respect and self-awareness. They achieve what they call self-awareness by intuitively interacting on social media. Nobel laureate Daniel Kahneman writes that "intuition is nothing more than recognition", which is a long logical argument and the ability to automatically find solutions without proof [11]. Intuition is the ability to acquire knowledge without resorting to conscious thinking. This can reduce the quality of introspective preferences and decisions. Research by Wilson and Schuler has shown that causal analysis reduces people's satisfaction with their choices, and it may not always be a good idea to analyze the reasons for preferences very carefully [12].

Practical exchange of information allows trainees to learn and expand their knowledge. If a post meets the personal needs of users and users' favorites, they will be willing to share this new and happy experience and even feel flattered. People naturally strive for growth, which Maslow calls self-realization [13].

Motivating respondents is the opportunity to get positive reviews and make a name for themselves to meet the expectations of others. How you interact with your audience is the key to your success. Media artists are an economic model that creates "emotional pragmatism" and develops aesthetic mobility by building relationships and emotions with participants.

The development of social mobility is closely related to their interest in innovation in all spheres of society, which leads to the desire to acquire the learning process, knowledge, and skills. Social mobility, behavior and emotions have been driving motives of human development for millennia. It seems to us that our mind is unwittingly looking for the "right" solution for innovation. The "average performance" of human mind leads to maximum motivation and ultimate success. Based on this, the optimal performance model is a high-level performance mechanism that implements the strategic actions and aspirations of social network users in managing the human factor when exchanging information in uncertain or specific situations.

In this process, human emotions reveal their first impressions of aesthetic appeal and interest in artwork. Emotion and art are closely intertwined, and interest in art enhances the aesthetic tastes and students' experiences. A study by Wilson and Schuler found that students preferred fun and artistic posters because of their ability to speak easily, but that preference was dropped when there was no need to explain why [14]. Thoughtful and interesting impressions artworks reveal the ideological purpose of the author through this work.

Psychologist Martin Hoffman believes that everyone from birth can empathize [15]. Social media allows an artist to build relationships with their followers by sharing their art and personal experiences or adventures, giving insight into artists' lives, which gives the audience a sense of being connected to the artist.

Our analysis of sociological survey data shows that:

- ➢ (91%) Instagram was the most preferred social media platform and (94%) Instagram was the most used art-related social media. The main motives for using social media are sharing art, selling art and meeting other artists.
- ➢ 37% of artists publish 5-10 posts per week, 46% of artists communicate with their subscribers more than 10 times a week.
- ➢ 80% of artists deny that their favorite paintings are their favorite works.
- ➢ 63% of artists deny that interactions between their favorite artwork and their followers will affect the creation of their next artwork.
- ➢ 63% of artists have not adapted their work for their followers.

To get positive feedback and meet others' expectations of social media engagement and creative endeavors - to tell others about what you think is important, you need to develop skills and open new opportunities to feel better. This can be called self-awareness.

Some people think social media is discrediting art, and Phil James argued that social media is destroying art and literature [16]. Stephanie Charlow

believes that social media is beginning to destroy creativity and pose a threat to the artist [17]. Stephanie Kelly stresses that social media is not about destroying art, but about democratizing it [18]. However, a survey of artists shows that most artists are devoted to their inner creativity. Male artists seem to be more inclined to customize art for their followers.

Social media is designed to move people as individuals and groups and includes six compelling ways of psychological impact, including interaction, social facts, love, authority, scarcity, and commitment [19]. Social media has democratized art by allowing people to transform art and share experiences using more mobile phones. Art becomes the motivation for artistic experience, and "artwork" becomes an experience created and transmitted by users. Social media interactions led to civic curatorship, with civic curators eliminating linear didactic relationships between museums and participants.

Interactivity in religious and educational settings is rarely increased because it means that there is no serious interpretation, or these approaches are populism.

According to some art managers and artists, viewers may not be able to grasp the meaning of interpretation skills required to determine the meaning and value of artwork due to their low level of knowledge, field knowledge and skills. The visual experience of art includes complex, possibly cognitive and emotional components.

Perception processing is usually faster than knowledge processing. Russell studied a wide range of stimuli, including traits modifying traits, motives, empathy, emotional meta-experiments, and emotional regulation of exposure. If participants identify artwork that fits our mentality, then the student's spiritual worldview replaces careful analysis of artwork with generalized concepts based on non-critical, contemporary-oriented social psychology.

Instagram, as an image-driven online data exchange program, only allows for quick, superficial interactions. People often judge by intuition. Irrational information can only play the role of starting point in "artistic experience", but it cannot replace the experience of seeing real "art", it can just be an illusion.

Jiajia Fei points out that if art moves through social media, then the creation of artworks can follow the algorithm [20]. Second, visual art is a complex stimulus, and we have not discussed the effect of aesthetic stimulus (such as lines, shapes, and colors) on the perceiver. Despite its limitations, our research represents a step towards a better understanding of how visual art is perceived and valued, as well as a better understanding of social media interactions and citizen curating.

Social media is a consumable product that allows people to relate to art quickly and superficially, while visual art is a complex incentive. Whether evaluating art is just a treatment of intuition, or artwork you enjoy the most are related to aesthetics or quality, they all deserve further study. In addition, the visual arts category has many subcategories, and future research may focus on the cognitive differences between the different categories. Soon, the impact of social networks will be multifaceted, cross-industry communication is relevant, and creative ideas can deeply and constantly change, a conscious understanding of culture of social networks is needed to create a new architecture of social mobility. It is essential to effectively address complex ethical issues.

Conclusion

After collecting data on Instagram, we conducted an extensive analysis of interaction between artists and public, identifying the characteristics of their favorite artworks and how interaction with the audience affects their creativity. The results show that my favorite artwork is more interactive. The favorite and most commented artworks, filtered by the participants, are based on human instinct. Self-awareness is the biggest driving force behind social media interactions.

Social media has changed the way people think about images and offer many filters and design tools to make images more beautiful. Various artworks are quickly displayed on social media in a design + photography form, and the interaction between them is important. Popular culture such as Instagram and modern image aesthetics have been built around social media. Time requires the creation of social networks as a platform not only for studying contemporary art, but also for studying the evolution and dynamics of artistic culture.

The interaction of social media has a huge impact on artistic institutions and the way of population's lifestyle, and as media technology updates, the artistic experience and culture of participation will continue to change. Our research expands the possibilities for studying the interaction of mobile social networks in the art world, which is significant for the study of interactive psychology of creative works and digital marketing communications on social networks. What cultural resources do participants need to feel themselves as translators of the meaning and value of art? It is important to note that the interaction of experts requires the emergence of new social norm because of how these sources and the technique of hermeneutic process are related to each other.

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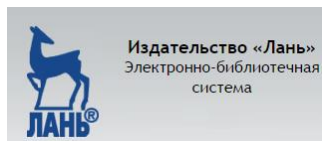
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