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DESIGN SKILLS, CREATIVITY AND MOTIVATION: EXPERIMENTAL STUDY IN RUSSIAN ART AND DESIGN EDUCATION

DOCTORAL DISSERTATION SUMMARY

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1. Introduction

This dissertational study investigates the influence of Design-Based Learning (DBL) on the design skills development, creativity and motivation of students in Russian Art and Design Education (ADE). ADE in Russia has a rich past steeped in traditional methods but is now trying to adopt modern techniques. Even though it has a strong cultural background, the current education system experiences difficulties in adjusting to modern requirements, especially in developing scholars' creativity and practical skills.

The relevance of this experimental study relates to the fact that there is increasing concern about the need for individuals who possess 21st century skills. The constantly evolving society requires people to have professional skills, ideas and the ability to adapt and enhance themselves and their performance (Kadyjrova et al., 2022). Today's employers have estimated a set of specific hard and soft skills such as critical thinking, stress management, and digital competencies, among others can meet the contemporary market conditions (Ryazanova, 2023). This study also discusses another issue which is the lack of substantial projects that graduates possess from their portfolio to assess their suitability for job opportunities. It raises questions on whether the current practices in learning institutions adequately equip the students with relevant skills and experience that enable them to compete competitively in the job market. According to Titor (2023), only 8% of graduates from the professional educational organizations in Russia can be considered to be ready for their job, therefore, new training methodologies like DBL need to be embraced in order to increase portfolio size, quality, and employment rates. On the other hand, the incorporation of vocationally oriented education into the labor market demands draws attention to the synergy between the business community and the education sector in fostering socio-economic development (Helman et al., 2022). However, it is necessary to note that modern educational systems have to reconsider their aims and objectives in order to strengthen students' creative and social capital to make them ready for the demands of a digitalized economy (Voronin & Iontseva, 2021). In addition, recruitment of a new generation of workers is also necessary in order to attract the best talents to operate new equipment and at the same time, firms need to ensure that they have all the competitiveness required to operate in a volatile business environment (Kuznecov & Osipova, 2022).

Analyzing the results of the conducted research on the three-level training results in the sphere of Russian ADE, one can conclude that it had not resulted in the enhancement of the offered education quality intensiveness (Bilyatdinova et al., 2016; Misyukevich & Kalandarova, 2019; Lu et al., 2022). Based on the research evidence the following explanations can be postulated to have led to this outcome. Today's entrants are yesterday's schoolchildren, and, often, they have not even gone through an art school. However, for it is rather hard to assume that they will be better prepared at the end of the four-year terms of study at a university than the graduates of an art school. Practical training

and the acquisition of skills and abilities, on the one hand, as well as serious theoretical preparation, familiarization with the history of art and the psychology of art-making, on the other, the acquisition of the best experience from the best-known art schools are needed (Roshchin & Filippova, 2020). Nevertheless, there are two more years of a master's degree and four years of a doctoral degree, and maybe, a student will successfully metamorphose into an expert during this period. However, at the same time, practice shows that even for this period of time, it is still difficult to ensure the development of general and professional horizons, an individual's practical skills, and abilities in the framework of a chosen field of study. Russian higher education is struggling to provide the quality training that new social requirements are demanding. The need to encourage creativity and to ensure that knowledge can be put to practice in a short time is especially acute for design students. The evidence indicates that, even after formal training, the skill to creatively tackle professional problems is not sufficiently developed (Daskova et al., 2020). Even taking into account that some students manage to gain these skills successfully, it gets even harder after Russia's withdrawal from the Bologna process (Dorenko & Morozova, 2023). Another research stresses the institutional falls of Russian higher education reforms that failed to improve the quality of education. The authors criticize the reform approaches that did not work to enhance education outcomes to meet the socio-economic requirements of the nation. None of the projects actually improved the social effectiveness of higher education, and this has resulted in development gaps between regions in Russia (Kurbatova et al., 2020). Despite there have been attempts to introduce more sophisticated design processes and digital technologies, the absence of a unified and relevant training strategy led to insufficient progress in educational quality (Stratonova et al., 2022). Additionally, researchers point out ongoing problems in Russian colleges and universities from the viewpoint of companies that hire graduates. The research highlights such issues as low level of professionalism and qualification of the graduates and demotivation of the young specialists. The institutional initiatives directed to the promotion of university-industry collaboration were weak, this fact complicated the problem of insufficient quality of Russian ADE (Maximova et al., 2016). Stratonova and colleagues (2021) analyzed the integration of new teaching technologies and the transition to project-based learning directions in Russian ADE. According to the researchers, there is a need to create a new paradigm of an educational environment that prepares individuals for an innovative modern society, capable of producing multifunctional specialists with creative and project thinking. However, the application of these methods is still difficult because of the cultural resistance and traditional approaches that dominate the organizations. Regarding the change of perspective in education, another research focuses on spiritual, moral, and aesthetic development. The lack of time for perceiving these values, common in the context of the current accelerated information flow, also affects the students' creativity and the overall progression of their skills within the art and design field (Bugaev, 2020). Another study deals with the necessity

of revamping design learning through more practice-based cooperation and a system of continued education. The author notes that such an approach indicates the need to initiate pedagogical processes that motivate students to involve creative initiatives for the emergence of professional competencies in future designers. Nevertheless, there are still some issues present, such as the absence of an applicative component, a problem-based approach that does not involve real-life situations (Amelina, 2023). Kiselev (2022) pointed to the fact that many graduates of Russian higher education are not ready for job settings. The problem lies in the approach of educators since they have only borrowed foreign educational models and did not adapt them to the Russian context, which led to a gap between education and actual economic needs.

The underlying problems in modern ADE in Russia have motivated us to create the Toolkit for Studying and Assessing of Design Activity (TSADA), which consists of the Motivation for Creativity Questionnaire (MCQ), the Assignments and Requirements for Art-project Work (ARAW), and the Control and Final Diagnostics Sheets (CFDS). The present study contributes to the understanding of ADE in Russia and the advantages of DBL implementation by expanding the empirical data on this topic. Regarding the novelty of this dissertation research, it is the first study that rigorously analyses the development of DBL within the Russian ADE context. Although there is a global interest in DBL and its application, especially in Russia's educational system DBL has not been sufficiently studied. Moreover, this research for the first time empirically assesses the impact of DBL on students' design skills, creativity, and motivation in one study within the Russian context. In addition, contemporary educational theories like constructivist learning and design thinking are included in conventional Russian art and design curriculum in this research. The approach used in this dissertation closes the gap between traditional teaching styles and contemporary learning practices which results in effective curriculum structuring concepts. By filling this knowledge gap, the study presents an unusual geographical as well as a cultural angle that makes an addition to existing education knowledge. The practical significance of this work transcends boundaries, it offers applicable suggestions for the joint application of DBL into current educational systems and increasing the relevance and quality of ADE delivered in Russian universities.

2. Methodology

The purpose of the experimental study is to investigate whether the self-created instrument - Toolkit for Studying and Assessing of Design Activity (TSADA) is effective in developing and applying design skills, encouraging the creativity and motivation of students during their art-project work.

Research Questions:

RQ1. Does the Motivation for Creativity Questionnaire (MCQ) measure the factors of students' motivation (intrinsic, achievement, failure avoidance and extrinsic) in Russian art and design education?

RQ2. Does the Motivation for Creativity Questionnaire (MCQ) measure the elements of students' creativity (divergent thinking, originality of ideas, persistent attitude and intellectual risk-taking) in Russian art and design education?

RQ3. What is the effect of students' motivation on their creativity in Russian art and design education?

RQ4. Do the Control and Final Diagnostic Sheets (CFDS) effectively assess students' design skills (research, communication, product-creation, presentation, reflective) and the product of design activity after the Assignments and Requirements for Art-project Work (ARAW) treatment?

RQ5: Is there a noteworthy contrast in the progression of design skills between the experimental group with Design-Based Learning (DBL) and the control group with Lecture-Based Instruction (LBI)?

RQ6: Is there a significant difference in the progression of design skills and the product of design activity between the experimental and control groups?

RQ7: Are there significant differences in the development of design skills and the product of design activity between genders?

RQ8: How do students' motivation aspects predict the development of their design skills?

RQ9: How do students' creativity aspects predict the development of their design skills?

RQ10: What are the predictions of variables such as group, gender, and motivation aspects on students' design skills development?

RQ11: What are the predictions of variables such as group, gender, and creativity aspects on students' design skills development?

RQ12: Is there a significant interaction between groups and genders on students' motivation, creativity, design skills, and product of design activity?

Research Design:

In the experimental study, the pretest-posttest nonequivalent comparison group designs were used. The pretest-posttest nonequivalent comparison group designs are the research designs used in experimental studies to evaluate the effects of an intervention or treatment on a group of participants (Gliner et al., 2017). In this design, two groups of participants are selected: an experimental group that receives the intervention and a comparison group that does not receive the intervention. The participants in each group are not randomly assigned, which is why they are considered nonequivalent. The design involves measuring the outcome variable of interest for both groups before

and after the intervention (Trochim & Donnelly, 2006). The pretest serves as a baseline measurement to assess the initial equivalence between the groups. Following the intervention, the posttest measures are taken to evaluate any changes that may have occurred as a result of the intervention. The key assumption in this design is that any differences observed between the groups' posttest scores can be attributed to the intervention itself, rather than preexisting differences between the groups (Shadish et al., 2002). As the basis of our experimental study, we used the Design-Based Learning (DBL) framework. DBL represents an educational methodology that integrates the principles of design thinking into the learning process, with a focus on hands-on, experiential tasks where students confront genuine design dilemmas (Kolodner, 2002). DBL fosters active involvement, critical analysis, and problem-solving abilities by immersing students in authentic design endeavors. It highlights iterative design procedures, cooperation, and ingenuity, enabling students to apply theoretical understanding to practical scenarios and cultivate proficiencies pertinent to professional design work (Kimbell, 2012). The teacher's role within this framework is to facilitate learning by inspiring and sharing experiences related to addressing design-related challenges while students engage in DBL art-projects. Consequently, teachers pose probing questions to deepen students' understanding of design tasks, provide continuous feedback on technical design progress to enhance domain expertise and empower students by placing them at the forefront of the activity (Kadyjrova et al., 2020). Acting as consultants, teachers prompt students to articulate engineering concepts during discussions and presentations, fostering reflective practices to elucidate the rationale behind technical design decisions.

Instruments:

The Toolkit for Studying and Assessing of Design Activity (TSADA) is a self-developed instrument which is based on the DBL approach to working with ADE students, which consists of:

1. The Assignments and Requirements for Art-project Work (ARAW) is a self-developed instrument which compresses 5 art-project assignments with evaluation criteria and is aimed at the development and implementation of the design skills (Appendix A).

2. The Control and Final Diagnostics Sheets (CFDS) is a self-developed instrument which includes 6 diagnostic sheets for evaluation of the design skills (research, communication, product-creation, presentation, and reflective) and the final product with the use of a 5-point Likert scale (Appendix B).

3. The Motivation for Creativity Questionnaire (MCQ) is a self-developed instrument that consists of 39 statements that evaluate the resulting tendency of motivation and creativity with the use of a 5-point Likert scale (Appendix C).

Participants:

The pilot was conducted in Russia (Republic of Tatarstan) and involved 193 participants for the validation of the three instruments, such as the MCQ questionnaire, ARAW, and CFDS instruments. The sample consisted of Russian ADE field students from Kazan Federal University and Kazan State Institute of Culture, aged 19-23 years. In the study, we used purposive sampling, a non-probability sampling method.

The main study was also conducted in Russia and involved 207 third-year bachelor ADE students from Kazan Federal University and Kazan State Institute of Culture. The purposive sampling was used among participants aged 19-23 years. The sample was divided into two groups. In the control group (n=102), there were 27 (26.5%) boys and 75 (73.5%) girls, while in the experimental group (n=105), there were 29 (27.6%) boys and 76 (72.4%) girls. Both groups represented diverse ethnicities and varying socioeconomic statuses but had approximately the same background, level of knowledge, and skills.

3. Results

In the dissertation, we conducted two experiments compressed in the pilot and main studies. The pilot study investigated the effectiveness of the self-created TSADA framework, which consists of the MCQ, ARAW, and CFDS instruments during the art-project work of design students in Russian ADE. In the pilot study, we addressed several research questions (*RQ1-5*). In the main study, we established the effect of Design-Based Learning (DBL) on design skills acquisition compared to Lecture-Based Instruction (LBI). Moreover, we explored the difference between the genders, as well as motivation and creativity aspects as predictors for design skills development. In the main study, we also answered a number of research questions *(RQ6-12)*.

First of all, we used the analyses of EFA and construct validity measures of MCQ. The original questionnaire had twenty-five items; however, there were twenty items left after running EFA. In EFA, to know which items belong to which factors, there were 5 items in the factor of intrinsic motivation, 7 items in the achievement motivation, 4 items in the failure avoidance motivation, and 4 items in the extrinsic motivation. Factor loadings that were lower than 0.4 were suppressed in this study. The reason for the lower factor loadings of these five items may be the lower sample size (n=193) of this study. However, this number of participants is a huge amount because, at the current age, there are few students specializing in Russian ADE at universities and colleges. After EFA, it is necessary to confirm the construct validity of MCQ which is in line with Şeker's (2013) suggestion. Therefore, we confirmed its construct validity (based on convergent and discriminant validities). Different measures of CR, AVE, and internal consistency reliability (Cronbach's alpha) proved the convergent validity of the motivation dimension of MCQ. Then, HTMT ratios which were

lower than .85 (*<.85, recommended value) also confirmed its discriminant validity. Based on the results we can state that the MCQ is effective in evaluating student's motivation and creativity in Russian ADE.

Based on *RQ1*, we interpreted that the MCQ questionnaire was reliable and valid for measuring students' motivation and creativity aspects in the field of Russian ADE. We conducted an EFA on the MCQ and analyzed its construct validity for the motivation dimension of the instrument. The EFA resulted in the deletion of five items from the initial 25-item questionnaire due to low factor loadings. The refined questionnaire identified four main factors with 20 items and a KMO measure of 0.752, indicating good sampling adequacy: intrinsic motivation with 5 items, achievement motivation with 7 items, failure avoidance motivation with 4 items, and extrinsic motivation with 4 items. Convergent validity was confirmed through internal consistency reliability (Cronbach's alpha), composite reliability (CR), and average variance extracted (AVE) values. Discriminant validity was confirmed using HTMT ratios, which ranged from 0.08 to 0.65, below the 0.85 threshold.

Regarding *RQ2*, we also analyzed EFA for the creativity dimension of MCQ. There were 19 items left out of the original 25 items in this dimension after deleting six items with lower factor loadings (<.4, Kline, 2011), which occurred due to the lower sample size of this study. We found four different factors: 9 items in divergent thinking, 3 items in the originality of ideas, 5 items in the persistent attitude, and 2 items in intellectual risk-taking. For the construct validity, we analyzed its convergent validity (investigating its Cronbach's Alpha, CR, and AVE values) and its discriminant validity based on the comparison of the square root of AVE and factor correlations (Oo et al., 2021). The construct validity of this creativity dimension was also confirmed.

In *RQ3* we explored the effects of students' motivation factors on their creative performance in Russian ADE with the help of structural equation modeling in AMOS. We found out that students' intrinsic motivation had a significant positive impact on students' creative performance such as divergent thinking, originality of ideas, persistent attitude, and intellectual risk-taking in ADE; however, their extrinsic motivation had no significant impacts on their creativity. This finding is in line with many other studies (Amabile et al. 2002; Amabile & Pillemer 2012; Zhu et al., 2018). This may be the reason for the nature of Russian ADE and students who pay more attention to their inner urges rather than extrinsic motivation such as rewards or punishments. Achievement motivation, as another important factor of students' motivation, also had a significant impact on students' creative performance. This finding is also the same as the findings of some studies (Miksza, 2011; Strenacikova & Strenacikova, 2020). These positive impacts may stem from Russian students' strong will, deep perspectives, and belief to achieve in their creative works of ADE. As for the case of students' failure avoidance motivation, some negative significant impacts were found on their creative performance. It means that if Russian students have more avoidance motivation, they will not succeed

in their creative performance in art and design education. Some studies (Heimerdinger & Hinsz 2008; Schüler et al., 2013; Icekson et al., 2014) also agreed with this finding of our research that students' avoidance motivation can undermine their creativity because of their uncontrollable cognitive factors such as threat appraisals, stress, and anxiety to perform their creative works. Furthermore, extrinsic motivation had also some negative impacts on their creative performance. This finding is also in line with Amabile's (1996) finding that students' performance under the extrinsic orientation was significantly low-creative in ADE. In fact, some studies (Guay et al., 2010; Amabile & Pillemer, 2012; Donald et al., 2020) supported that extrinsic motivation such as rewards, punishments, and different kinds of social supports or incentives can have positive impacts on students.

The investigation into *RQ4* demonstrated that the CFDS serves as an effective tool for evaluating students' design skills comprehensively after the ARAW treatment. As evidenced by Rasch analysis, EFA, and CFA, the CFDS showcased reliability in evaluating the scope of design skills. EFA results showed satisfactory internal consistency with Cronbach's alpha coefficients varying between 0.75 to 0.85 for different items of design skills, stating that the instrument is reliable. Composite reliability (CR) coefficients also affirmed the reliability of the instrument and ranged between 0.80 to 0.90. Furthermore, the AVE coefficients supported the convergent validity that ranged from 0.60 to 0.75, justifying that the CFDS provides the intended assessment of the specified constructs. Further validation through discriminant validity measures, including HTMT ratios, confirmed the CFDS's ability to distinguish design skills from other constructs, with HTMT ratios ranging from 0.30 to 0.50. All these means, that the CFDS emerges as a valuable assessment tool for evaluating students' design skills, encompassing research, communication, product-creation, presentation, and reflective skills within the Russian ADE context. Moreover, the research highlighted that the CFDS effectively assesses students' products created during art-project work, considering attributes such as uniqueness, aesthetics, convenience, functionality, and environmental friendliness within the context of Russian ADE. Cronbach's alpha and composite reliability (CR) assessment signified internal consistency and reliability to conduct an efficient assessment of art-products through the CFDS. Cronbach's alpha values were found to vary from 0.76 to 0.82 for the different items of art-product. Further, results revealed satisfactory convergent validity indexes such as average variance extracted (AVE) which ranged from 0.55 to 0.65. Discriminant validity measures, especially HTMT ratios ranging from 0.45 to 0.55., also supported the effectiveness of the CFDS in distinguishing art-products from other constructs. In summary, the CFDS emerges as a reliable and valid assessment tool for evaluating students' art-products in Russian ADE, considering essential attributes such as uniqueness, aesthetics, convenience, functionality, and environmental friendliness. Its comprehensive evaluation framework facilitates a thorough assessment of students' artistic creations and outcomes.

In *RQ5* we investigated the significant differences between the experimental group which was given the DBL treatment and the control group with LBI treatment. The findings showed that the experimental group that was given the DBL treatment was significantly better than the control group without it. This finding aligns with other studies (Prince & Felder, 2006; Kimbell, 2012; Clavert & Laakso, 2013) showing that DBL is more effective than other traditional teaching strategies in teaching design skills development. Moreover, it aligns with Thandlam Sudhindra's et. al (2022) study fostering the development of design skills and productive attitudes by DBL. The possible reason may be that in the experimental group, students independently completed the art-project assignment of the ARAW. In this art-project assignment, students were given freedom of choice and planning. The teacher was a facilitator for the experimental students, explaining the requirements for completing tasks, and giving advice and opportunities to create their design skills tasks. In the assignments, students accumulate and apply knowledge while engaging in artistic endeavors. Consequently, teachers pose questions to deepen comprehension of design tasks, offer ongoing feedback on technical design progress as a means of building domain expertise, and place students at the center of the activity. The teacher acts as a consultant, prompting students to articulate engineering concepts during discussions and presentations, and encouraging reflective practices to elucidate the rationale behind technical design decisions.

Before going to address the *RQs* in the main study we compared the baseline of motivation, creativity, and design skills between the control and experimental groups before the experimental treatment. The research study employed independent samples t-tests to compare the mean scores of the motivation, creativity, and design skills of the participants. Results showed that both groups were approximately equally motivated, possessed similar levels of creativity, and had similar design skills development before the implementation of the DBL program.

In *RQ6* we found out the difference between the experimental and the control groups in the development of design skills and quality of the product of the ARAW. Independent sample t-test analysis revealed that there was no significant difference in the initial conditions of design skills between the two groups. Further analysis using Analysis of Covariance (ANCOVA) showed a statistically significant difference in favor of the experimental group in terms of design skills at the end of the experiment, the posttest mean scores are higher taking the pretest scores into consideration. Furthermore, the differences were statistically significant for all six factors of the design skills enhancement and the product of the design activity between the control and experimental groups. Higher results were observed in the experimental group in favor of the developed skills and the final product as compared to the control group. The results confirmed that DBL can be employed as a practical and beneficial teaching strategy for the students' design skills development and the overall improvement of the quality of their design activity and products. The presented results can be

beneficial for educators and curriculum designers to promote the inclusion of DBL into educational programs for motivation and creativity, problem-solving, and innovation enhancement. This finding supports the assertions made in the studies (Doppelt, 2009; Johnson et al., 2014; Bozkurt & Tan, 2021), which reveal that DBL can foster design skills, motivation, and creativity by providing realistic and purposeful experiences.

In *RQ7*, the differences in the design skills and the product of design activity by gender were identified. The ANCOVA analysis was used in this study. The analysis revealed that there was gender difference (weak effect size) with the male performing better than their female counterparts. Nevertheless, in two-way ANOVA analysis, there was no significance noticed in the improvement of the students' design skills in terms of gender, but only in terms of groups. The obtained results converge with other researchers (Voyer et al., 1995; Ro & Knight, 2016), indicating that male participants tend to perform better in the mental rotation and spatial perception tasks. This might be because female design students tend to use collaborative problem-solving strategies, whereas male students are more inclined towards the competitive and self-centred types of problem-solving strategies within the experimental contexts. Another possible reason is that women are minorities in some specific design fields such as architecture and engineering. This fact does not illustrate insufficiency in the design abilities development of women but states possible systemic barriers, as noted by Rissler et al. (2020).

The impact of motivational factors on students to the development of their design skills was analyzed in *RQ8*. The result of the prediction model indicated that students' intrinsic motivation, achievement, and failure-avoidance motivation had a positive significant effect on design skills acquisition. However, the analysis did not reveal a significant predictive effect of extrinsic motivation on students' design skills. Such motivation has less influence in resolving multi-faceted challenges in ADE. Furthermore, the motivation in ADE is internal rather than external, where students' passion for creative problem solving is more relevant than the teacher's and colleagues' recognition or reward and punishment system. This research finding corresponds to other research studies (Johnson et al., 2014; Pérez & Rubio 2020) that also show that the students' engagement in motivational tasks can enhance design skills performance.

RQ9 was the examination of students' creativity aspects on their design skills development. The prediction model showed that students' aspects of divergent thinking, originality of ideas, and persistent attitude are crucial for predicting students' design skills development. This finding is similar to other researchers' findings (Dym et al., 2005; Kim & Hannafin, 2011), focusing on the influence of DBL in empowering students' creativity for design skills acquisition. Another study (Chu et al., 2017) also showed that students' divergent thinking encouraged students to think beyond conventional solutions and consider alternative approaches. However, no significant predicting effect

was found by students' intellectual risk-taking on their design skills development. The possible reason may be that students were not willing to take a risk in their art-project works. Cross (2004) supported our research findings, highlighting the importance of creativity in the prediction of designers' practical and creative skills, as well as addressing authentic societal challenges and in enhancing the relevance and impact of DBL art-projects to produce design skills in ADE.

RQ10 touched upon the exploration of predictive effects regarding group (control and experimental), gender (male and female), and motivation factors relating to students' design skills enhancement. The regression analysis indicated that the students' groups and motivational aspects significantly and positively predicted their design skills development. However, the analysis found gender as a non-significant factor in students' design skills development. Skills related to design are quite personal even regardless of gender. Additionally, no significant difference was observed between male and female participants in RQ7. Some other studies (Hidi & Harackiewicz, 2000; Hattie & Timperley, 2007; Szalay et al., 2021) are also in line with our research findings.

In *RQ11* we investigated the predictive effects by group (control and experimental), gender (male and female), and creativity elements on students' design skills development. The logistic regression showed that group and creativity aspects have significant predicting effects on students' design skills acquisition. Other studies (Dym et al., 2005; Kim & Hannafin, 2011; Chu et al., 2017; Anderson et al., 2019) also showed that creativity aspects enhance students' willingness to iterate and innovate in their designs, and experimental projects nurture students' creativity, refine their designs based on feedback and reflection (Dorst & Cross, 2001). However, as in the previous RQ10, gender showed no significant effect on design skill development. Personal interest and creative aspects are essential variables in the process of design skills development, showing that students who are more interested in design works are more likely to invest effort and time into developing their skills, regardless of their gender. Some other studies (Hidi & Harackiewicz, 2000; Hattie & Timperley, 2007; Szalay et al., 2021) are also in line with our research findings.

In *RQ12*, for evaluation of the interaction between groups and genders on motivation, creativity, design skills, and art products of students we conducted ANCOVA. Analysis revealed that there was a statistically significant difference between the mean scores of the experimental and control groups regarding motivation, creativity, and design skills. Students in the DBL group had higher scores in creativity, design skills, and product assessments, as well as motivation in contrast to the LBI group. Some other studies (Hmelo-Silver et al., 2007; Doppelt et al., 2008; Richard, 2016; Meinel et al., 2020) are also in line with our research findings. However, the findings did not reveal any significant differences in these factors between male and female students. This implies that both genders are almost equally placed in Russian ADE and have similar opportunities for accessing teaching aids and assistance. This finding is similar to other researchers' findings (Garber et al., 2014;

Lillegård et al, 2021). With the help of two-way ANOVA, we established the relationship between groups and genders on the development of variables (creativity, motivation, design skills, and art product) and found no significant interaction. According to the findings only the group evidenced to have significant interaction with the development of these variables. The results of a correlational analysis revealed that students' motivation was moderately related to creativity, design skills, and product of art-project activity. Creativity, in turn, was highly related to design skills and product development. This research finding corresponds to other research studies (Gero & Kannengiesser, 2004; McKay, 2013; Bhamra & Lofthouse, 2016).

4. Conclusion

In the present experimental study, for the development and validation of self-created instruments, which were used to increase the effectiveness of ADE through DBL methodologies, a multi-faceted approach was employed. After conducting a thorough analysis of the literature and consulting with experts in the field of ADE, we created the Toolkit for Studying and Assessing Design Activity (TSADA), which comprised three self-designed instruments. The first instrument was called the Assignments and Requirements for Art-project Work (ARAW) and aimed at improving design skills through five progressively structured art-project assignments. The ARAW assignments were designed to promote research, communication, product-creation, presentation, and reflective skills in design students. The second tool, the Control and Final Diagnostic Sheets (CFDS), outlined standards for measuring students' skills in various phases of the DBL framework. The CFDS, with a systematic form of assessment, yielded concrete metrics on which the students' skills and art-product could be evaluated. The last assessment tool, the Motivation for Creativity Questionnaire (MCQ) was designed to assess participants' motivation and creativity propensities. The MCQ, which was constructed from creativity and motivation theories included statements in order to reflect the respective dimensions of creativity (divergent thinking, originality of ideas, persistent attitude, and intellectual risk-taking) and motivation (intrinsic motivation, extrinsic motivation, achievement motivation and failure avoidance motivation). Feedback gained from the experts supported the applicability of the instruments helping students to navigate in the DBL process, cultivate domain-specific knowledge and skills, evaluate the quality of the final product, as well as measure motivation and creativity. In sum, the experimental research shed light on the effectiveness of the implementation of DBL approaches into art and design curricula, focusing on the necessity of structured assignments, and clear evaluation criteria. The self-developed TSADA contributes to the systematic approach to knowledge and skills development and gaining practical experience among students in the field of ADE.

In the pilot study we aimed to assess the utility of the TSADA instrument, which consists of the MCQ, ARAW, and CFDS in Russian ADE. Findings from the research revealed positive results.

The pilot study responded to several research questions that highlighted the level of reliability, validity, and effectiveness of the instruments towards enhancing the students' motivation, creativity, as well as their capability in designing. The psychometric properties of the MCQ were established, and the results confirmed the reliability and validity of the MCQ as a tool to assess students' motivation and creativity. The results of structural equation modeling showed that intrinsic and achievement motivations had a strong positive effect on students' creativity, pointing to self-motivation and purpose to master as the key determinants of highly creative outcomes. On the other hand, avoidance motivation had a negative influence on creativity, supporting the fact that fear of failure hinders creativity. These results extend our knowledge of motivation and creativity in the context of ADE emphasizing the specificity of their interconnection. Moreover, the CFDS was recognized as being helpful in comprehensively evaluating students' design skills, as well as possessing high reliability and validity coefficients to its effectiveness. By using Rasch analysis and CFA tests, the CFDS proved its efficiency in the assessment of different aspects of design skills as well as the quality of art-products developed during the art-project activities. Such characteristics make it possible to provide a more extensive assessment of students' artwork in terms of originality, beauty, utility, and etc. The use of the ARAW instrument in improving ADE was established to have been effective in promoting the concept through structured assignments and well-defined criteria. As a result, the ARAW fosters research, communication, product-creation, presentation, and reflective skills in students by allowing them to experience the process of working on domain-related art-projects. Quantitative comparison of the scores between the experimental group that underwent the TSADA framework and the control group that engaged in the conventional teaching method showed significant gains in knowledge and skills acquisition in the experimental group, supporting the effectiveness of DBL in ADE.

The main study focused on the research questions concerning the efficiency of DBL compared to LBI in developing students' design skills, creativity and motivation. Additionally, we studied the role of group and gender, creativity and motivation as predictors for design competencies acquisition. We established several significant findings that help in extending the knowledge base on instructional strategies and conditions promoting students' development in ADE. First, it was identified that there were no significant differences in design skills, motivation and creativity between the control and the experimental groups before the DBL treatment. Later, quantitative data analysis showed that there is a statistically significant difference between the groups. The experimental group with DBL outperformed the control group with LBI in terms of design skills development and quality of art product, level of motivation and creativity. This points to the potential of DBL as an instructive approach for increasing student's learning achievement in ADE. Moreover, the research analyzed gender differences and revealed a significant but low-size effect with males outperforming females

in design skills. Other variables such as motivation factors, creativity aspects and group significantly predicted design skills acquisition. Regarding the predictive role of motivation, it was found that intrinsic and achievement motivation have a positive and significant impact on the development of design skills, while extrinsic and failure avoidance motivation had significantly less positive impact. In the same way, elements of creativity such as divergent thinking and originality of ideas define design skills development, although the persisting attitude and intellectual risk-taking were not statistically significant.

We would like to propose several potential recommendations for policymakers, educators, and researchers focusing on ADE, which are grounded on the analysis of the literature and the results obtained from experimental studies. Policymakers should encourage the use of DBL methodologies in the national curriculum to help students develop domain-related competencies, creativity, motivation, problem-solving, and collaboration. It is important to invest in creating a favorable learning environment, structured assignments, and clear evaluation criteria. Moreover, investment in professional development programs for educators is essential to raise understanding regarding DBL implementation and strategies for continuous improvement of students' learning. Curriculum development that is put inside both technical and conceptual pedagogical frameworks derived from research into cognitive processes, motivational aspects, and effective approaches to teaching is needed. Teachers should incorporate DBL activities within education processes to encourage experimentation, teamwork, and reflection; using tools such as TSADA to enhance the quality of ADE. The assessment through the CFDS and MCQ-like instruments can be done frequently to be aware of the strengths and weaknesses of the education students are receiving. In future studies, the researchers should explore the lasting effects of DBL activities on the students' competencies, refining and improving the tools such as TSADA. Additionally, there is a need to study other potential predictors that may have an influence on art and design competence such as cognitive abilities, emotional intelligence, prior experiences in ADE, and socio-cultural backgrounds of students. This information will help researchers/educators to be better equipped in giving appropriate interventions such as differentiated instruction, skill practice, and supporting learning environments fully responsive to learners' needs, hence promoting equity in ADE. Above mentioned recommendations can be used to increase the quality and relevance of ADE in Russia and Europe.

The present experimental study gives a strong theoretical and practical foundation on design skills, creativity, and motivation within ADE and evidence of the positive application of self-created TSADA instrument in enhancing art and design competencies. It demonstrated how motivation, creativity, students' design skills and products of art-project activity can be fostered with the use of DBL. It provided recommendations for policymakers, researchers, teachers, and other educational stakeholders about constructive and effective methods that should be employed in the class in order

to support different learners and encourage them to comprehend educational material. The conducted research expands knowledge in the fields of pedagogy, psychology, and art and can be useful in enhancing the learning outcomes of students in ADE and the overall practice of educators and scholars.

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