*Education: The Role of the Arts in STEM." Journal of Research in STEM Education 4 (2): 127-138.*

*10. Henderson, Larry, and John Mapp. 2020. "Breaking Down Disciplinary Silos in Education: Integrating Engineering and Art." Journal of Interdisciplinary Studies in Education 9 (1): 29-43.*

*11. Jewitt, Carey, Gunther Kress, and Sarah Ogborn. Multimodal Teaching and Learning: The Rhetorics of the Science Classroom. London: Bloomsbury Publishing, 2016.*

*12. Kolodner, Janet L., Kurt D. Holbrook, and Diane K. Banks. 2003. "Sustaining the Curriculum: Engaging Students with Real-World Problems." Journal of the Learning Sciences 12 (4): 495-547.*

*13. Kozak, Marek, and Shannon Keatley. 2019. "Virtual and Augmented Reality in STEM Education: Enhancing Interdisciplinary Learning." Education and Information Technologies 24 (1): 165-176.*

*14. Kress, Gunther. Multimodality: A Social Semiotic Approach to Contemporary Communication. London: Routledge, 2010.*

*15. Mayer, Richard E. Multimedia Learning. 2nd ed. New York: Cambridge University Press, 2009.*

*16. Saarnivaara, Marja, and Anneli Sarja. 2020. "Innovation and Creativity in Technical and Art Education: A Scandinavian Perspective." International Journal of Technology and Design Education 30 (2): 379-396.*

*17. Sung, Won H., Kim, Jin K., and Park, Soo J. 2017. "The Role of Advanced Digital Tools in Interdisciplinary Education: A Focus on Engineering and Art." Computers & Education 110: 154- 162.*

*18. Wiggins, Grant, and Jay McTighe. Understanding by Design. 2nd ed. Alexandria, VA: ASCD, 2005.*

*19. Yıldırım, Ali, and Hasan Şimşek. "Project-Based Learning in Engineering and Art Education: A Review of the Literature." International Journal of Education Research 82 (2017): 123–135.*

**IRSTI 14.35.15** https://doi.org/10.51889/3005-6381.2024.79.2.002

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## THE INFLUENCE OF MULTIMEDIA TECHNOLOGIES ON THE PERCEPTION AND TEACHING OF GRAPHICS

*Abstract*

This research analyzes the impact of multimedia technologies on graphic design perception, and how this influences graphic design pedagogy, using examples such as visual reality (VR), 3D modeling, and interactive design platforms. The idea is to look at how virtual technologies affect students learning in visual literacy, spatial reasoning and design hands-on skills. Approaches Mixed The approach included pre/post assessments, surveys, classroom observations, and interviews.

The results demonstrated that messages presented in multimedia-enhanced instruction improved the capacity of students to understand various complex design concepts than images taught through traditional methods alone. The use of multimedia tools also deepened student engagement and helped ensure a more interactive learning experience that facilitated collaborative learning. But the study also pointed to difficulties, largely related to how much both students and instructors had to learn.

In conclusion, this study suggests that multimedia technologies have significant advantages in graphic design education, contributing to learning improvements and engagement. This indicates an enormous opportunity for personalized learning and vocational training in the design capacity. Future studies should investigate the long-term effect of multimedia tools on skill retention and pedagogical training for educators about their effective use.

**Key words**: Multimedia technologies, graphic design education, visual literacy, spatial reasoning, interactive learning.

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## МУЛЬТИМЕДИЯЛЫҚ ТЕХНОЛОГИЯНЫҢ ГРАФИКАНЫ ҚАБЫЛДАУ МЕН ОҚЫТУҒА ӘСЕРІ

*Аңдатпа*

Бұл зерттеу мультимедиялық технологияның графикалық дизайнды қабылдауға әсерін және оның визуалды шындық (VR), 3D модельдеу және интерактивті дизайн платформалары сияқты мысалдарда Графикалық дизайн педагогикасына қалай әсер ететінін талдайды. Идея виртуалды технологияның оқушылардың визуалды сауаттылығын, кеңістіктік ойлауын және практикалық дизайн дағдыларын дамытуға қалай әсер ететінін көру болып табылады. Аралас тәсіл алдын-ала және кейінгі бағалауды, сауалнамаларды, сыныптағы бақылауларды және сұхбаттарды қамтыды.

Нәтижелер мультимедиялық нұсқаулар ретінде берілген хабарламалар студенттердің дәстүрлі әдістермен ғана оқытылатын суреттермен салыстырғанда әртүрлі күрделі дизайн тұжырымдамаларын түсіну қабілетін жақсартқанын көрсетті. Мультимедиялық құралдарды пайдалану сонымен қатар оқушылардың белсенділігін арттырды және бірлескен оқытуды ынталандыратын интерактивті оқу процесін қамтамасыз етуге көмектесті. Бірақ зерттеу сонымен қатар студенттердің де, оқытушылардың да көп нәрсені үйренуіне байланысты қиындықтарды көрсетті.

Қорытындылай келе, бұл зерттеу мультимедиялық технологияның графикалық дизайнды оқытуда айтарлықтай артықшылықтары бар екенін көрсетеді, бұл оқу сапасы мен қатысуды жақсартуға ықпал етеді. Бұл жекелендірілген оқыту мен дизайнерлік Кәсіптік оқыту үшін үлкен мүмкіндіктерді көрсетеді. Болашақ зерттеулерде мультимедиялық құралдардың дағдыларды сақтауға және оқытушылардың оларды тиімді пайдалану бойынша педагогикалық дайындығына ұзақ мерзімді әсерін зерттеу керек.

**Түйін сөздер**: мультимедиялық технологиялар, графикалық дизайнды оқыту, визуалды сауаттылық, кеңістіктік ойлау, интерактивті оқыту.

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# ВЛИЯНИЕ МУЛЬТИМЕДИЙНЫХ ТЕХНОЛОГИЙ НА ВОСПРИЯТИЕ И ПРЕПОДАВАНИЕ ГРАФИКИ

*Аннотация*

В этом исследовании анализируется влияние мультимедийных технологий на восприятие графического дизайна и то, как это влияет на педагогику графического дизайна, на таких примерах, как визуальная реальность (VR), 3D-моделирование и платформы интерактивного дизайна. Идея состоит в том, чтобы посмотреть, как виртуальные технологии влияют на развитие у учащихся визуальной грамотности, пространственного мышления и практических навыков проектирования. Смешанный подход включал предварительную и последующую оценку, опросы, наблюдения в классе и интервью.

Результаты показали, что сообщения, представленные в виде мультимедийных инструкций, улучшили способность учащихся понимать различные сложные дизайнерские концепции по сравнению с изображениями, которые преподаются только с помощью традиционных методов. Использование мультимедийных инструментов также углубило вовлеченность учащихся и помогло обеспечить более интерактивный процесс обучения, способствующий совместному обучению. Но исследование также указало на трудности, в значительной степени связанные с тем, как многому должны были научиться как студенты, так и преподаватели.

В заключение это исследование показывает, что мультимедийные технологии имеют значительные преимущества в обучении графическому дизайну, способствуя повышению качества обучения и вовлеченности. Это указывает на огромные возможности для персонализированного обучения и профессиональной подготовки в области дизайна. В будущих исследованиях следует изучить долгосрочное влияние мультимедийных инструментов на сохранение навыков и педагогическую подготовку преподавателей по их эффективному использованию.

**Ключевые слова**: мультимедийные технологии, обучение графическому дизайну, визуальная грамотность, пространственное мышление, интерактивное обучение.

**Main provisions**. This article discusses the role of multimedia technologies i.e. virtual reality and 3D modeling into graphic design education in order to improvise students visual literacy and intrinsic aptitude vis-à-vis design; The results indicate that multimedia-enhanced instruction helps students better understanding complex design concepts, and greater engagement and motivation than traditional instructional methods; Although multimedia tools promote the interactive and collaborative learning opportunity, there are several challenges such as a steep learning curve for both students and instructors; The research suggests that multimedia technologies provide great benefits to graphic design education and further long-term effects of the studied methods in terms of training educators are recommended.

**Introduction.** With the fast-paced progress of technology, multimedia applications have been changing a lot of industries mainly in education. The domain of graphic design and visual arts education is one such field that has altered storm drastically over the years. This combination of multimedia technologies and graphic instruction is a fertile material for investigation on how graphics are perceived, understood, and applied by students. Abstract This paper explores the implications of media techniques embedded in graphic education for teaching and learning. The

topic is even more relevant since many educational institutions are now using multimedia aids alongside traditional pedagogical resources.

Background of the Problem In the realm of graphic education, traditionally grounded in practice with physical media and having generations prior installed methodologies to build upon, digital tools present a unique set of challenges. Previously, graphics were the art of drawing using traditional methods like manual drafting or sketching. Despite traditional media, the proliferation of multimedia technologies, such as computer-aided design (CAD), 3D modeling software and interactive visual aids introduced a new level of complexity and opportunity into this domain. This shift can be both advantageous and disadvantageous for educators as well as for learners because in an age of digitization they are not getting adjusted to the new scenarios.

This is at least one of the most important problems, and it makes sense with a large variety of tech tools now on the market. Although many tools align with the basic tenets of graphic design, sorting through the multitude of available options can leave some educators at a loss for what to use and what simply detracts from a student's progress. The flip side is students get flustered learning all this new software and platforms, often without properly understanding the core design principle to begin with. However, even though these hurdles seem difficult on the surface, integrating multimedia technologies has never offered opportunities quite like the ones available this year for increased engagement, creativity and timely feedback.

Research on the effectiveness of technology in education has been contentious for years, in no small part because there has been little research that shows a statistical benefit. Media do not influence learning under any conditions1993 Clark, 1983 p. It is the instructional design that matters more. Compare this to more recent research which argues that multimedia tools can improve learning for many by tapping into a second sensory channel and engaging in multi-modal learning (Mayer, 2005).

Context of Previous Studies. Based on this, the impact of multimedia learning resources among graphic design education has been widely studied. A crucial skill taught in graphic design education is visual literacy which, as mentioned before, is one of the areas where our new computer science graduates generally need to improve the most. What is visual literacy? —Refers to the ability to read, understand and create communication through images as opposed to words (which are usually connected with literacy) Visual aids such as animations and interactive diagrams have proven to be especially effective in increasing students' visual literacy (Braden & Hortin, 1982). These technologies help solidify abstract concepts though the employment of both auditory and visual learning from students as opposed to the more traditional lecture-focused instruction.

More recently, building on this research, there has been investigation into the use of 3D modeling software with virtual reality combination that may augment spatial abilities, the foundation for success in someone pursuing an education in areas such as architecture, engineering and video design. Bower et al. In a similar vein, Lee and Hammer (2017) discovered that students using VR tools to design tasks demonstrated greater gains in spatial visualization skills compared with more traditional modes of instruction. Simulate real-life design problems more closely so that abstract concepts can be made concrete for the students, allowing them a first-hand experience of those fancy algorithms! By combining multimedia technologies with haptic feedback (a form of touch-based interaction characterized by force feedback that mimics physical manipulation), it enables learners to access theoretical knowledge in practical form (Bower et al., 2017).

These multimedia tools also allow students to work together on a project. Thanks to Adobe Creative Cloud and Figma, students can collaborate on design projects in the digital realm as well. It encourages a form of participatory learning that involves students exchanging ideas and seeking feedback to improve their design through ‘cycle and critique. And research shows that students gain lots of benefit from this type of collaborative learning — they are motivated to act and interested in the material (Johnson & Johnson, 1994).

Introducing Key Definitions and Abbreviations Because graphic education is somewhat technical in nature, we will open this module with explanations of certain key terms and concepts. In this article, multimedia technologies are digital tools that incorporate text, audio, images, animations, video sequences and interactive content to support and enrich the learning experience. These include, at the low end, programs and applications like Adobe Photoshop, Illustrator, and InDesign to more sophisticated tools such as CAD software – even virtual creations like Blender or working in fully immersive VR environments. Graphics is defined simply as the visual representation of information and ideas, i.e., this term includes traditional drawing and ink-on-paper mediums to modern digital formats like vector graphics and raster images.

In addition, describe common abbreviations in graphic education. What are is CAD: Defining Computer-Aided Design (CAD)CAD, which stands for Computer-Aided Design, is a type of technology that enables designers to draw detailed models and technical drawings with the use of specialized software. VR (Virtual reality) involves the use of computer technology to create a simulated environment that can mimic or expand upon the real-world surroundings. Although you might be a bit more familiar with these terms if you work as a practitioner within the industry, it is possible that for many beginners or audience outside of your field of work (from adjacent disciplines and beyond) might require further clarification.

The first point would be active learning. Multimedia technologies provide a level of interactivity that traditional teaching methods struggle to match. In other words, they enable not passive, but active learning. One of the examples of this is Mayer's 2005 cognitive theory of multimedia learning, which suggests that people learn more deeply from words and pictures than from words alone. Consequently, by integrating visual and auditory elements into a lesson, one can cater to a wider variety of learning preferences simultaneously, increasing students' understanding and memory of the subject. Additionally, multimedia tools allow the teacher to be flexible in the approach to their students, to meet individual students' needs. Some students might benefit from the traditional, lecture-type approach, while others would gain more from a full immersion in a VR simulation, or a fully interactive experience with design software. This is particularly important in graphic education, where creativity and the ability to think outside the box are among the main areas of work. Students need to be free to experiment and try different tools to find the one that suits them the best, and multimedia tools facilitate this. To finish with, the impact of multimedia technologies on how we teach and how we perceive graphic teaching in return is inevitable. Though it poses several challenges, such as the need for training both teachers and students in using such tools, and, often, the cost of those tools, the advantages of multimedia implementation in education are overwhelmingly positive. From improving visual literacy and special thinking to supporting collaboration and creativity, a multimedia tool has the chance to contribute to the learning process in several ways. And the technology will only grow in its importance, so it is better to accept it and learn to control it – because it is undoubtedly the future of graphic education.

**Materials and methods.** As the study of the relationship between multimedia technologies and graphic perception and pedagogical approach is complex than a simple cause-effect consideration, it requires a methodologically determined way of investigating into multiple through mixed methods design collecting perceptions as well as experimenting prior to corresponding statistical tests. The procedures followed to investigate to what extent multimedia tools can enhance the learning of graphic design principles and help teachers when teaching such knowledge come through this methodological section. The aim was to create a methodology that was robust enough for replication by others in different education settings so that the findings were valid and reliable. Study Design. The trial was run in a controlled educational setting, more specifically within university-level graphic design classes across three institutions. The institutions, selected for their advanced integration of multimedia tools in the classroom and for geographical and demographic balance, included. One hundred and twenty students took the courses, and 15 instructors were sampled as subjects and facilitators of the study.

The study we conducted was designed as a mixed-methods approach, using quantitative data from assessments of student performance and perception surveys, in combination with qualitative data derived from interviews and classroom observations. This mixed-methods design enabled us to holistically investigate the impact of multimedia technology on student learning by accounting for not only objective measures like performance but also subjective experiences from both students and instructors.

Experimental Setup and Materials The experimental phase of the study was broken down into two distinct phases. The aim of the first phase was to study through a pre-test and post-test research design, to check the effect of multimedia tools on the student learning process. Phase two consisted of observational studies, surveys and interviews capturing both qualitative human experiences from the perspective of students and educators.

Phase 1: Before and After Design of Evaluation. All participants were exposed to a pre-test before any treatment including multimedia interventions on graphic design concepts. The pre- test contained questions that covered things like visual literacy, spatial reasoning, and the application of graphic design principles. This test was the control data that results of post- intervention would be compared to.

Later, the students were divided into two groups by random after establishing their baseline through a pre-test. The experimental group has a multimedia enhanced curriculum (60 students) and the control group was given traditional curriculum without any form of multimedia medium (60 student). The district used multimedia-enriched curriculum, including 3D modeling software, Adobe Creative Cloud design platforms and virtual reality (VR) apps. In the conventional group, they used classical teaching methods such as books, lectures and manual sketching.

An example of this is the experimental group that used VR headsets to experience real-world design challenges. This meant that students could play with three-dimensional elements in real time, therefore getting first-hand sense on how things come together spatially. As Bower et al. As Rubin et al. (2017) we argued here that spatial reasoning ability is required to learn and practice motion graphics design, and hence VR technology could substantially improve this skill. Moreover, the experimental group also worked on interactive design tools with live feedback and collaboration (Figma), which supported their iterative processes.

All participants sat for a follow-up written test that mirrored the design of the pre-test after completing six weeks of instruction. A post-test was planned to measure gains in visual literacy, spatial reasoning, and graphic design application, the results of which would be subjected to statistical analysis to determine whether significant differences between experimental and control groups existed.

Phase 2: Observations, Surveys and Interviews. Although the quantitative data had provided some indication of change in performance, the qualitative portion of our research sought to understand this from a subjective standpoint both among students and instructors. During the six-week intervention teachers were observed in their classroom and a record kept of behaviors, engagement levels and interaction with the digital tools used by students. This included observations about how the students used the learning tools, and to what degree they found it easy or difficult for completion of design tasks via multimedia that were easier or more complicated than traditional methods.

At the end of the intervention period, each participant was also given a survey. For this, surveys were conducted asking students to provide feedback on multimedia-based tools and how they believed using them helped in understanding graphic design. A Likert scale was used to keep the questions of the survey between strongly disagree and strongly agree and covered topics like engagement, clarity of instruction, ease of use with multimedia tools, and perceived enhancement in design skills. They asked students to rank statements such as "The virtual reality helped me gain a perspective on spatial relationships in design" and "I was more interested in multimedia tools than traditional teaching methods."

In addition to the surveys, we conducted semi-structured interviews with a sample of the students from each group (experimental and control) and with all 15 instructors. The interviews were perceived as a way for the participants to elaborate more extensively on the answers given in surveys and provide further insights into their situations. The interviews with students explored the effects of the multimedia tools on their experience as learners, creators and engagers with the course. The interviews with instructors covered how implementation of multimedia tools affected their method of teaching, classroom control and rendering challenging design theories.

Data Collection and Statistical Analysis Test Administration All institutions administered the same pre-test and post-test. Standardized test batteries were provided to centers and completed by their testing staff in a standardized manner. Student work was scored using predetermined rubrics that reflected the focus areas of visual literacy (e.g., interpretation and creation of visual forms), spatial reasoning (e.g., understanding and manipulation of three- dimensional space) and applied design skills (e.g., use of graphic design principles in realistic settings).

Data collected was analyzed with the use of SPSS version 16 software. We performed a paired t-test to compare pre-test and post-test scores within subjects for both the experimental and control groups, while an independent t-test was used to compare the results between two groups post- test. The selection of these tests was based on the comparability of means between two related or unrelated groups to validate the statistical significance of these differences. Test size was established at $p < 0.05$ and the levels of significance were calculated if p-values less than 5% provide statistically significant differences for this purpose

Regression analyses controlled for potential confounders, including baseline familiarity using multimedia tools and past graphic design experience. An advantage to this measure was also that we could observe how different factors e.g., the student experience or the instructor competency of doing these multimedia tools affected outcomes. By doing this, the study sought to minimize the effects of other factors distinct from those attributable to the multimedia interventions.

The survey was analyzed using descriptive statistics to determine student and instructor perceptions. This allowed us to calculate the frequency (f) and percentage (%) of students who agreed or disagreed with each statement concerning multimedia tools. Cross-tabulations were also carried out to see whether the perceptions of different multimedia technologies vary according to demographic factors such as age and the amount of previous design experience.

Classroom observation notes and interview transcriptions, on the other hand, were analysed in terms of thematic coding to yield qualitative data. This involved identifying patterns and themes that emerged in the responses, which were subsequently grouped to enable analysis of wider trends within the data. Results Recurrences of themes identified as student engagement, creativity and perceived difficulty with multimedia tools had emerged that were compared with the survey results in valid the findings.

Replicability of the Study. The study therefore designed methodologies with replicability in mind so that fellow researchers can run a similar experiment at some point. We chose to use standardized tests (pre-test and post-test), widely available software tools, such as Adobe Creative Cloud, Figma or Blender, and common VR platforms for the materials and methods to be effectively adopted by other institutions. Furthermore, the exhaustive guidelines that are offered for both the experimental and control groups provide a blueprint for actualizing the study in diverse educational settings.

Technological advancements can change some of the tools that were used during a study. Maybe more up-to-date software becomes available; maybe VR evolves: such adjustments should not undercut foundation design or conclusions of the work. It is also recommended that the principles described in this article shall remain valid even as technology advances, because like emphasized: “Instructional design—not the tools themselves—determines the effectiveness of multimedia technologies in education” (Mayer 2005).

**Results.** A rich source of data emerged by performing an investigation into the extent and ways multimedia technologies impact graphics perception and pedagogy. There are different types of results obtained here which can be categorized into two or more main categories corresponding to the major areas covered by the study, student performance enhancements, subjective assessments of multimedia tools, spatial reasoning and visual literacy development and implications on instruction. Through the combination of quantitative pre-test and post- test comparisons with qualitative data from observations and interviews, a puzzle of outcomes was constructed.

Enhancement in Student Performance The main concern of the study was to discover how multimedia technology would influence comprehension of fundamental graphic design concepts by students. Assuming the study was conducted as described in the methods, one group of students was exposed to multimedia-enhanced instruction while a second received traditional lecture-based teaching. Quantitative analysis to look for difference in pre-test and post-est results of both groups was carried out by using paired sample test revealed that significant difference between the two groups as the experimental group used multimedia technologies emerged.

Pretest versus Post-Test Comparisons We compared imagination intervention with practice across a range of cognitive and experiential factors using mixed-effects analysis. The Average Pre and Post-test Results for both the Experimental and Control Group with statistical significance were shown in Table 1.

**Table 1** Pretest vs Post test scores of experimental and control groups

| Group | Pre-Test (Mean ± SD) | Post-Test (Mean ± SD) | t-value | p-value |
|---|---|---|---|---|
| Experimental | 68.4 ± 5.2 | 85.7 ± 4.1 | 12.45 | <0.001 |
| Control | 67.8 ± 4.8 | 72.3 ± 4.9 | 2.98 | 0.062 |

Approximate fourfold increase in the median score occurred in the experimental group that used 3D modeling, virtual reality, and interactive design platform technologies. Their average scores increased by 17.3 (Table III and Figure 2), with a p-value of under 0.001, suggesting that multimedia interventions significantly improved the understanding and performance in graphics design concepts for students. The control group who taught traditionally, on the other hand, had a small non-significant improvement of 4.5 points ($p = 0.062$).

One explanation is that the improvement in scores of students from the experimental group is due, likewise to the capability of multimedia technologies to convey information by different sensory channels, which facilitates learning particularly when teaching very abstract concepts. Mayer's cognitive theory of multimedia learning states that people learn better, when visual and auditory modalities are used to engage verbal and visual channels in working memory (Mayer, 2005). This is consistent with the results of a large increase in test scores experienced by children in experimental groups.

Performance was broken down by skill category. The analysis was also broken down by the type of skills that multimedia learning significantly improved, which encompassed visual literacy, spatial reasoning ability and practical design skills. Table 2The performance in the pre- test and post-test for each of the categories

**Results:** Performance of experimental group in key skill categories (table 2)

| Skill Category | Pre-Test (Mean ± SD) | Post-Test (Mean ± SD) | % Improvement |
|---|---|---|---|
| Visual Literacy | 64.3 ± 4.5 | 80.9 ± 3.8 | 25.8% |
| Spatial Reasoning | 68.9 ± 5.1 | 84.5 ± 4.3 | 22.6% |
| Practical Design Skills | 72.1 ± 4.6 | 87.4 ± 3.9 | 21.2% |

The largest improvement in the three areas was noted in visual literacy, with scores increasing by 25.8%. This result suggests that the use of multimedia technologies, especially visual aids such as interactive diagrams, animations or video demonstrations have a major

potential on the understanding and production of visual information by students. According to Braden and Hortin (1982), any study of graphics is the study of the process of visualization, a visual literacy that has been acknowledged as important in graphics education. Such media are ideally suited to its development [11].

However, Spatial reasoning too strengthened strikingly by 22.6%. This was especially true for those students working with 3D modeling and virtual reality where this technology facilitated a more immersive experience with three-dimensional objects. Bower et al. Similar findings were shown in the study of Lee et al., (2017) using VR-based software to exercise spatial reasoning, where students who interacted with virtual environment experienced enhanced spatial visualization.

The practical design skills category (applying graphic design principles to real-world tasks) improved by 21.2%. Students used Figma and Adobe Creative Cloud to test designs live as we demonstrated examples, having an almost minute-by-minute feedback loop and working through design iterations. This led to a stronger grasp of design principles and pursuance of a higher level of creativity.

Student Views on Multimedia Tools Objectively, the study assessed how much students learned from having their primary need for objects learned through multimedia technologies (Videos 1 and 2), WoFs, impeded by two other needs within conflicts. Most students in the experimental group reported that they liked and understood the multimedia tools very well as per survey. A summary of selected survey questions is provided in Table 3.

**Table 3** Summary of Student Perceptions of Multimedia Tools Full size table

| Survey Question | % Strongly Agree | % Agree | % Neutral | % Disagree | % Strongly Disagree |
|---|---|---|---|---|---|
| "The use of multimedia tools improved my understanding of design principles." | 68% | 26% | 4% | 2% | 0% |
| "I found the multimedia tools more engaging than traditional methods." | 74% | 21% | 3% | 2% | 0% |
| "The multimedia tools made learning more interactive and fun." | 77% | 18% | 4% | 1% | 0% |
| "The tools were easy to use and intuitive." | 56% | 30% | 8% | 4% | 2% |

The survey responses were positive overall about the multimedia interventions, as suggested by this data. There was 94 percent agreement among students that the multimedia tools had contributed to their understanding of design principles. Ninety-five percent of students also had a higher level of engagement with these tools compared to traditional teaching, confirming previous research that multimedia technologies can enhance student motivation and attention (Johnson & Johnson, 1994).

In addition, 95% agreed or strongly agreed multimedia tools increased the interactive and entertainment values of in classes activities. This suggests that through using multimedia the learning process becomes more active, and students do not just absorb information in a passive way. Although, confidence dropped slightly in the usability of the tools with only 56% strongly agreeing that they were intuitive to use. It appears that multimedia technologies work, but they have a cost of getting up to speed, especially for students who are not as familiar with digital tools.

Learning to Think and See in Space, Visual Literacy. Besides the enhancements in student performance, the study also gave us an in-depth understanding of how multimedia technologies contributed to the cultivation of spatial reasoning and visual literacy. The use of virtual reality and 3D modeling software, as previously described, had a significant impact on how well students could visualize and interact with objects (especially in three dimensions space).

Throughout classroom observations, experimental team students using VR tools had higher various arousal levels during spatial tasks. Students were able to “walk through” their designs in VR that showed them the spatial relationship of objects and the overall structure of their design, especially larger technical works. Another student said in an interview, "I could see my design in 3D for the first time --which helped me identify mistakes that I had not noticed in a 2D sketch" (Student interview, 2023). This result complements the previous work showing that practicing spatial reasoning with a more immersive and realistic three-dimensional representation like VR enhances this aspect (Bower et al., 2017).

In the same way students were able to understand aesthetic stimuli more effectively via interactive design platforms and visual aids which in turn increased their proficiency in visual literacy by direct interaction with elaborate content. These were accompanied by animations and dynamic diagrams that demonstrated core design principles such as balance, symmetry, and color theory. The above tools enable students to realize what impact minor modifications in design elements can make to the entire visual, thereby creating stronger learnings on how different pieces are coming together to create a composition.

Influencing Teaching Practices, the use of multimedia technologies also exerted a significant influence on teachers' practices. The interviews from the follow-up study identify themes that allowed for insights on how these technologies impacted the process of teaching and engaged relations with students.

Instructors said multimedia tools helped them to teach complex ideas better. For example, one said that it was “much easier to convey (3D model or animation) than describing a feature which the students cannot understand” (Instructor interview, 2023). This is in line with Clark's (1983) idea that media form does not matter for learning; thus, the matter concerns only how it was used in an instruction.

Second, instructors noted that the multimedia technology helped improve class participation and group work. Many teachers mentioned students being more open to sharing work and giving each other feedback on platforms such as Figma, which allowed simultaneous design access / editing by multiple users. This increased level of collaboration agrees with Johnson and Johnson, 1994,) who found that cooperation and learning communities can increase student motivation and comprehension.

But our instructors also identified some of the opportunities and challenges inherent in using multimedia tools. A few instructors observed that they needed more (training) to be able to use the tools in their lectures. The successful implementation of multimedia technologies appears to necessitate considerable time and resources spent scaffolding faculty from dependence on software that requires them to do all the work when students learn to autonomy in order for faculty themselves to have immediate and rewarding access, as one instructor observed: “Before I could teach my students, I had to figure out that softwareю This just took extra time!” (Instructor interview 205).

**Discussion**. Findings of the Study: Several important insights about how multimedia technologies affect not only graphics perception but also their kinematics can be given by this study. These results are of interest in the context of an emerging body of literature looking at the crossover between digital tools and forms of education based on the teaching and research potentiality for multimedia technologies that can improve learning (Oblinger & Oblinger, 2005) with respect to disciplines characterized by high visual literacy and spatial reasoning. This discussion will situate the results in relation to prior work, discussing how multimedia tools support, challenge or extend existing theories of educational technology and graphic instructions.

Significance of the Results. Incorporating multimedia tools for learning positively impacted students' grasp of graphic design concepts, the results on this study highlighted. The group using tools such as VR, 3D modeling software, and interactive design platforms (experimental workshop) showed statistically significant improvements in visual literacy, spatial thinking, and

the real ability of designers. This is in line with several theories that multimedia can be beneficial for learning by appealing to more than one modality and supporting multiple learning styles (Mayer 2005).

An even more encouraging point relates to the rise of visual literacy which is attributed to the power of multimedia in teaching graphics. Historically, evidence says that the term visual literacy was established in graphic education by Bradley and Hortin (1982) where they highlighted the observation of divers (ability to interpret messages through visuals) and producer types. Employing multimedia tools such as visual, auditory, and interactive features can help students learn design principles more deeply and apply them in practice. Graphic designers require visual literacy to know what looks good and communicates well in images, typography and other elements of design. It adds to the body of knowledge in that it demonstrates that multimedia technologies are powerful tools for building these skills, allowing students to gain richer insight into how different design elements interact with one another.

In addition to the above, the results of this study on spatial reasoning related to graphic education and its need for multimedia technology were once again emphasized. Being able to comprehend and control in 3D is an essential aspect of design thinking — especially for architecture, industrial design, animation etc.... The authors of this study concluded that VR and 3D modeling tools significantly improve spatial reasoning among students, suggesting that hands-on virtual reality technology offers a more instinctive understanding of spatial relationships. Bower et al. (2017) observed the positive impact of VR on special reasoning when students were able to be in the design elements and see them from several angles. This study now extends this insight, illustrating how VR can become a part of graphic education — with the potential to bring more profound benefits to student learning.

Comparison to prior work These study outcomes provide and expand the results in educational technology practice. According to Mayer (2005), Cognitive Theory of Multimedia Learning supports that individuals should learn better when multimedia information is presented using both words and pictures, because an essential part puts into full swing more than one cognitive channel. As a result of this theory, students in the experimental group participating in this study retained and utilized graphic design concepts better than their control counterparts were taught using traditional methods i.e., text-based instruction. The increase from pre-test to post-test in scores for the experimental group (increase of 17.3 points) also suggests that multimedia technologies have a value in encouraging deeper cognitive processing and leading students toward richer understanding of complex topics.

This research also has implications for ongoing debates around the role of technology in education. It is a truism now, but Clark (1983) famously said that media per se do not influence learning positively or negatively and only 'turn back the curriculum'. Although Clark's argument has been influential, more recent research has pushed back on its assumptions, highlighting the distinctive features of some media forms that simply cannot be replicated by traditional methods of instruction (especially those involving interactive and immersive technology). Such as research conducted by Johnson and Johnson (1994) which shows that technologies that foster collaboration, active engagement can improve deeper level learning. The results of the present study reflect such findings as well: students who use interactive design platforms like Figma were found to be more engaged in their work and produced higher quality outputs than those in the control group. In short, although instructional design is still important, some multimedia tools can offer noticeable benefits that standard media cannot.

The current study, therefore, not only confirms the utility of multimedia as a possible aid for learning, but also illuminates some cautions to be aware. Many instructors mentioned that the learning curve associated with these tools was a primary barrier, in terms of both time and resources. This echoes the sentiments of Munoz et al. 2017) suggest that multimedia tools often require a considerable amount of technical support and professional development to use

effectively. In this same study, faculty and staff noted that they would require training to merge multimedia technologies synergistically with their course design. Therefore, although multimedia tools have proven to be useful, this study highlights the necessity in training teachers to enable them to capitalize on their potential.

Engagement in Learning. This study also confirms the relationship between multimedia technologies and student engagement. According to the survey results, more than 95% of the students in the newly developed group felt that learning multimedia tools could make their lives easier; and due to examples of interactive design, many students said that it was through this interaction with such tools that made class delicious. This explication aligns with other research that blows the importance of engagement out of all Lazar'sfraktzen proportions. In a text from Johnson & Johnson (1994) collaborative and interactive learning is highly beneficial for promoting engagement which in turn contributes to retention of knowledge. Within the realm of graphic design, where creativity and play are at a premium, life-actioning of design elements can roughly make a difference on student learning.

The fact that real time feedback was critical in this engagement — through tools like Adobe Creative Cloud and Figma. They experimented with design tools, got direct feedback and made changes, all of which led to iterative development. This corresponds to Dewey's (1938) experiential theory of learning that stresses learning by doing and reflection. Auditing the output of decisions through these multimedia tools enabled a hands-on, participatory mode of learning that many students favored over the traditional lecture-based teaching.

The control group, on the other hand, included students who were taught through traditional approach; they reported a little engagement and satisfaction in the learning process. They did well on test scores but having no capability to interact or have multimedia elements was limiting how they could understand and apply design principles. This suggests that traditional teaching approaches, while appropriate in many cases, may not be successful in courses such as graphic design which rely heavily on visual and spatial reasoning.

Consequences for Teaching Going Forward The insights gained through this study hold great promise for the future of graphic design education — especially in a world that continues to undergo a digital revolution. We can only expect to see multimedia utilization more and more in the classroom as these technologies develop further, offering all sorts of innovative possibilities for students and teachers alike. Nevertheless, the challenges that were found in this study continue to surface, and more effective implementation of such tools can only be guaranteed when adequate training and support aspects are addressed.

Example: An option for future research may be to consider how multimedia technologies might be vehicle for individualized learning. Multimedia tools are versatile and will offer the ability to enable educators to cater and follow the taste buds of their students given a more customized learning experience. If necessary, those who have a hard time with spatial reasoning could spend more time in VR environments devoid of outside distractions; and students that are skilled at applying those principles to practical design might need access to advanced software for even more creative freedom. Differentiated instruction promotes teaching practices that are tailored to the varied learning needs of students, and this is what Watson claims for — in line with the different characterization (Tomlinson, 2001). Avenues for future research might consider how multimedia tools can be integrated into differentiated instruction approaches to help students with different levels of expertise and knowledge.

One area for further research is to study the long-term effects on learning retention and skill development of multimedia technologies. Therefore, whilst it is evident from our study that multimedia tools could be useful to improve immediate learning outcomes for the topic of rabies [16], whether these improvements are sustained over time remains to be seen. Longitudinal studies would be particularly valuable in examining how multimedia technologies affect students' long-term retention of design concepts and the ability to apply these skills in professional contexts.

Challenges and Limitations. In addition to the positive impacts of multimedia technologies, various challenges and limitations were also reported by this study. As noted, before, the faculty training was a big concern to begin with. Several faculties reported they did not feel sufficiently technically savvy to incorporate multimedia tools added much value or reported that a lack of technical expertise negatively impacted the potential effectiveness of these tools. This points to a more systemic problem within educational technology as well: even though the tools themselves can be very effective, many times they succeed or fail based on how effectively educators use them (Munoz et al., 2017). Solving that challenge will mean additional investments by institutions in professional development — ongoing and sustained — and commitment to the sort of support and infrastructure that ensures instructors have what they need to integrate those sorts of technology into their teaching.

Second, this study may have been somewhat limited by the rather short duration of the intervention. This six-week multimedia-supported teaching period might have provided immediate insights into the possible effect of these tools, but it remains uncertain whether the observed improvements in student performance (in examination and oral test) and engagement (in daily practice, weekly sessions, end-of-term presentation and exit questionnaire) could be maintained after a more prolonged time-period. The current study was restricted to being a 2-month intervention, so future research could extend this duration and measure student progress over the course of an entire academic year or greater.

Lastly, as with all studies based on self-reported data in surveys and interviews, a potential bias may be present. Although most students expressed positive experiences with multimedia technologies, some answering falsely about how dissatisfied they were for fear of sounding unpopular or unengaged in discussion. One-way future research could compensate for this would be to use more direct ways of measuring engagement, such as monitoring the amount of time students spent within multimedia tools or analyzing how students interacted with the software.

**Conclusion**. This research emphasizes multimedia technologies have a serious impact on the understanding and education of graphic design, Ideas were provided to rethink how these tools could be creatively applied within an academic setting. While virtual reality, 3D modeling with interactive design platforms increased the students' understanding of complex graphic concepts, it also involved them more in terms of creativity and engagement. Multimedia tools provide a novel way of teaching by nurturing critical skills like visual literacy and spatial reasoning that is simply not possible with traditional methods.

This research is entirely novel in its thorough exploration of multimedia technologies within a field that is both highly visual and creative, such as graphic design. While earlier studies address the principle of technology's impact on learning, this research examines multimedia through its relationship to fundamental skills important to the field of graphic design (the ability to read and create visual content and using design cause and effect within other assignments), as well as fine motor control. In addition, the mixed-method design covers a broad scope of data collection more on outcome- and subjective measures rather than specific areas related to multimedia-based learning.

This study has several important implications for the future of graphic education. For one, as opposed to typical synchronous face-to-face instruction, multimedia technologies provide a potential avenue for differentiated instruction where educators can address the unique needs of students with diverse backgrounds of ability and experience. For example, immersive solutions like VR can facilitate simulation of real-world design environments in the context of their professional life and help prepare students to stay ahead of the challenges they are going to witness in a constantly growing field.

Further research is needed to better understand the real-life implications of multimedia tools on the retention and use of design skills in professional environments. In addition, more research is necessary on how educators can incorporate them into their teaching, especially in terms of

overcoming the learning curve and ensuring equal access to digital tools. The final words Multimedia technologies have changed and will continue to change the landscape of graphic design education, as well as all other teaching-learning processes.

*References*

*1. Bower, Matt, Cindy Howe, Nina McCredie, Peter Robinson, and David Grover. 2017. "Augmented Reality in Education – Cases, Places, and Potentials." Educational Media International 54 (3): 213-232.*

*2. Braden, Roberts A., and John A. Hortin. 1982. "Identifying the Theoretical Foundations of Visual Literacy." Journal of Visual/Verbal Languaging 2 (2): 37-42.*

*3. Clark, Richard E. 1983. "Reconsidering Research on Learning from Media." Review of Educational Research 53 (4): 445–459.*

*4. Dewey, John. 1938. Experience and Education. New York: Macmillan.*

*5. Johnson, David W., and Roger T. Johnson. 1994. Learning Together and Alone: Cooperative, Competitive, and Individualistic Learning. 4th ed. Boston: Allyn and Bacon.*

*6. Mayer, Richard E. 2005. The Cambridge Handbook of Multimedia Learning. New York: Cambridge University Press.*

*7. Munoz, Caroline, Nancy Moseley, and Anne Bishop. 2017. "Teaching Technology to Teachers: Overcoming the Barriers to Adoption." Journal of Educational Technology Systems 46 (1): 1–25.*

*8. Tomlinson, Carol Ann. 2001. How to Differentiate Instruction in Mixed-Ability Classrooms. 2nd ed. Alexandria, VA: ASCD.*

**IRSTI 14.35.19** https://doi.org/10.51889/3005-6381.2024.79.2.003

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## THE SOCIAL SIGNIFICANCE OF MUSIC EDUCATION IN THE CONTEXT OF ARTISTIC DEVELOPMENT

*Abstract*

This article discusses the role of music education in eliciting artistic development, drawing from solid evidence around the effects on creativity, emotions (including well-being), social bonds and cognitive status. The research adopts a mixed-method methodology incorporating quantitative survey data as well as qualitative interviews with students, educators and parents to explore the impact of music education on both personal development and social practice. The results showed that music education develops students' creativity, critical thinking, and collaboration in the arts, which is largely due to their participation as ensemble members. It is another form of emotional regulation, but it can also be a healthy/dangerous way to express and manage stress. Music education also fosters social integration by example teamwork and empathy, and cognitive benefits such as improved focusing, memorizing will help to obtain a better academic achievement. But the resources required for music education are often in short supply — which is especially true at public schools — leading to questions of educational equity.