

Constructing and Prospecting a Data-Driven Precision Teaching Model for Visual Communication Design Major

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Abstract: This paper proposes a data-driven precision teaching model specifically designed for the visual communication design major. By utilizing data analytics, the model aims to personalize learning experiences, enhance student engagement, and improve educational outcomes. Key features include real-time feedback, continuous curriculum adjustments, and active stakeholder collaboration, creating a dynamic and responsive educational system. The paper explores the theoretical foundations of the model, its technological integration, ethical challenges, and future research opportunities. Additionally, it stresses the importance of longitudinal assessments, equity in education, and collaborative research to align the model with the evolving demands of the workforce. The conclusion highlights the transformative potential of this model to reshape education in the visual communication design field.

Keywords: Data-driven Education; Precision Teaching; Educational Technology

1. Introduction

The visual communication design major is a dynamic and multidisciplinary field encompassing disciplines such as graphic design, illustration, photography, and digital media. As a profession closely linked to technological advancements and societal shifts, it requires a curriculum that is both innovative and adaptable to constant change. With the rising demand for skilled visual communication designers, educational institutions face the challenge of preparing students to meet industry needs while nurturing creativity and critical thinking.

1.1 Research Background

A major challenge in the field is the rapid pace of technological advancement. The introduction

of digital tools, especially computer-aided design (CAD), has transformed how designers work, reducing time spent on manual tasks and increasing digital fluency [1]. This shift has prompted design education to adapt, requiring new pedagogical strategies that integrate technology into teaching. The emphasis on innovation and adaptability further demands that students develop the skills to navigate an evolving professional landscape [2].

Another critical issue is the diversity in student backgrounds and learning styles. The visual communication design major attracts students with varying levels of expertise and experience. Traditional teaching methods often fail to address this diversity, highlighting the need for more flexible and personalized educational strategies [3].

The integration of data-driven technology in education presents a valuable opportunity to tackle these challenges. Data analytics can inform curriculum design aligned with industry trends, facilitate the incorporation of technology into learning, and enable the personalization of educational experiences. By leveraging data, educators can better understand student performance, engagement, and needs, leading to more targeted and effective teaching strategies.

This research is significant in its attempt to bridge the gap between traditional education and the evolving demands of the visual communication design industry. By proposing a data-driven precision teaching model, this paper contributes to ongoing discussions on educational innovation, offering a framework that enhances the quality and relevance of visual communication design education.

1.2 Research Background

The integration of data technology in education represents a transformative shift from traditional methods to a more adaptive, personalized framework. In visual

communication design, where creativity and technical skills are equally important, data technology allows educators to tailor instruction to individual student needs, enhancing both engagement and learning outcomes.

Data technology facilitates the collection and analysis of large datasets, offering educators insights into student behavior, progress, and interactions with design tools. Through learning analytics, educators can track skill development and provide timely, targeted feedback, ensuring personalized support where needed [4]. Adaptive learning systems, driven by real-time data, adjust curricula dynamically, allowing for personalized pathways that reflect each student's strengths and challenges [5]. This is particularly valuable in creative fields, where students vary widely in technical expertise and artistic inclinations.

Data technology also supports institutional decision-making by enabling evidence-based approaches to resource allocation, curriculum development, and teaching strategies, ensuring alignment with industry trends [6]. This ensures students acquire the skills necessary for success in a rapidly evolving, technology-driven landscape.

In summary, data technology offers a powerful, personalized, and adaptive approach to education. In visual communication design, where creativity and technical proficiency are critical, data-driven strategies better support student development and prepare them for a competitive industry.

1.3 Research Purpose and Significance

The primary goal of this research is to develop a conceptual framework for a data-driven precision teaching model tailored to the specific needs of the visual communication design major. The model aims to harness data analytics to create a more adaptive, personalized, and effective learning environment. By focusing on real-time data collection and analysis, educators can adjust their teaching strategies based on individual student progress, leading to improved outcomes and deeper engagement.

This research holds multiple layers of significance. First, it addresses the need for a curriculum that is flexible and future-oriented. In a rapidly changing field like visual communication design, where technological

advancements and industry demands evolve continuously, students must be equipped to adapt to new tools and trends. The proposed model leverages data technology to keep the curriculum aligned with future industry needs, ensuring students are not only proficient in current design methods but also prepared for ongoing developments [7].

Second, the research emphasizes personalized learning. The diversity of student backgrounds and learning styles in visual communication design requires an approach that caters to individual strengths and weaknesses. A data-driven precision teaching model allows for the customization of learning pathways, offering targeted support and enabling students to progress at their own pace [8]. This tailored instruction promotes inclusivity, ensuring all learners, regardless of starting point, can succeed.

Additionally, this research contributes to the broader conversation on educational innovation. As institutions increasingly adopt data analytics to enhance teaching, this framework demonstrates how data-driven approaches can be applied in creative fields like visual communication design. By integrating real-time data into teaching practices, educators can make evidence-based decisions that improve both individual outcomes and the overall educational experience [9].

In summary, this research aims to bridge the gap between traditional teaching methods and the evolving demands of the visual communication design industry. Through a data-driven precision teaching model, it offers a roadmap for how educational institutions can use data technology to enhance the quality, relevance, and inclusivity of their programs.

2. Literature Review

The literature highlights the transformative potential of combining precision teaching with data-driven insights in modern education. Precision teaching's detailed measurement and frequent feedback systems, when integrated with the broader analytical capabilities of data-driven approaches, offer a powerful means to enhance personalized learning. This synergy enables real-time adjustments to curricula and teaching strategies, addressing diverse student needs effectively. Additionally, the shift toward data-informed decision-making

supports more responsive and adaptive educational frameworks, preparing students for the rapidly evolving demands of industries like visual communication design. The reviewed literature provides a strong foundation for the development of a precision teaching model that leverages these insights to create a more dynamic and tailored learning experience.

2.1 The Evolution of Data-Driven Education

Data-driven education has evolved from basic administrative functions to advanced systems that leverage big data and learning analytics to enhance teaching and learning. Initially, data collection focused on tasks like tracking student enrollment and performance, offering limited insights into individual learning behaviors.

With the rise of big data, educators now use learning analytics to monitor student engagement in real-time, tailoring teaching strategies to individual needs. This shift enables a personalized approach, moving away from uniform teaching methods.

Beyond improving instruction, data-driven education informs institutional decision-making. By analyzing student performance patterns, institutions can predict risks like dropouts and implement more effective interventions [10]. This predictive analysis has proven vital in improving student retention and success, especially in higher education.

Data analytics also supports competency-based education, where students progress based on mastery rather than time spent in class. This approach offers flexibility to meet diverse learning needs and supports lifelong learning.

2.2 Data in Educational Decision-Making: Case Studies and Applications

The practical impact of data-driven decision-making in education is evident through numerous case studies. A key area of success is the early identification of at-risk students. By tracking indicators like attendance, engagement, and assignment completion, institutions can predict issues and implement timely interventions. For instance, Purdue University's use of predictive analytics has significantly improved retention rates and academic performance.

At the Open University in the UK, a data-driven feedback system provided personalized

learning recommendations based on student engagement, allowing educators to adjust course content and teaching methods in real-time, improving student satisfaction and outcomes. This responsiveness has proven essential in enhancing educational effectiveness.

Data also informs broader institutional decisions. By analyzing student achievement and course participation trends, universities can optimize curricula, allocate resources efficiently, and make informed choices regarding course offerings and faculty deployment. This ensures alignment between educational practices and both student and institutional goals.

Competency-based education also benefits from data-driven approaches. Data allows for precise tracking of student progress toward mastering specific skills, enabling personalized learning paths and clearer assessments of student readiness for the workforce [11].

These examples illustrate that data-driven decision-making enhances not only instruction but also institutional management, improving responsiveness to student needs, academic outcomes, and resource optimization.

2.3 Precision Teaching: Historical Context and Modern Relevance

Precision teaching, developed by Ogden Lindsley in the 1960s, was grounded in behaviorist principles, focusing on the frequent measurement of student performance to inform instructional adjustments. The core concept was to use continuous feedback to quickly identify learning challenges and provide targeted interventions.

Incorporating modern technologies, precision teaching now leverages digital tools for real-time data collection, allowing for more accurate tracking of student progress and the creation of personalized learning paths. This adaptability is particularly effective in fields like visual communication design, where students develop at different rates [12].

3. Data-Driven Precision Teaching Model Design for Visual Communication Design Major

The data-driven precision teaching model is built around three core elements: data collection, personalized learning, and curriculum development. Data is collected from

multiple sources, such as student interactions with design tools and performance metrics. This information helps educators understand individual learning needs and adapt their teaching accordingly.

Personalized learning paths are then developed based on the data. Each student's strengths and weaknesses are addressed, allowing for a more targeted learning experience. In the context of visual communication design, where skill levels vary widely, this approach ensures that students receive support tailored to their development.

Curriculum development is a continuous process. As data reveals new insights about student progress and industry trends, the curriculum is updated to stay relevant. This ensures that students are prepared for the evolving demands of the design field.

3.1 Setting Precise Teaching Objectives

In the data-driven precision teaching model, setting clear and actionable teaching objectives is critical. These objectives provide a framework for both educators and students, ensuring that learning remains focused and aligned with industry expectations. The process begins with an in-depth analysis of current trends and skill demands in the visual communication design field. By identifying the core competencies required by the industry, such as proficiency in digital tools, creative problem-solving, and adaptability to emerging technologies, educators can set objectives that are both relevant and forward-looking.

Simultaneously, student data plays a vital role in shaping these objectives. Performance analytics, engagement metrics, and feedback from previous assessments provide a detailed understanding of individual learning patterns. This data helps to refine the objectives, making them specific to the diverse needs of students. For instance, if data reveals that a group of students struggles with mastering certain design software, targeted objectives can be set to address this gap through additional training or practice.

The model emphasizes the creation of SMART objectives—Specific, Measurable, Achievable, Relevant, and Time-bound. These objectives ensure that teaching is goal-oriented, with clear benchmarks for success. Educators can measure progress effectively, providing timely interventions where necessary. This continuous feedback loop between data insights and

teaching goals supports a dynamic learning environment where objectives evolve as new data is collected.

Collaboration with industry professionals and feedback from students further enhances the relevance of these teaching objectives. By engaging stakeholders in the process, the model ensures that the objectives not only reflect academic standards but also prepare students for real-world challenges. This alignment between academic and industry expectations is key to ensuring that graduates possess the skills required to thrive in a competitive job market.

In summary, setting precise teaching objectives in this model allows for a highly structured yet flexible approach to education. The objectives are continually adapted based on data insights, ensuring that both individual student needs and broader industry trends are addressed. This adaptability is essential in a field as fast-paced and evolving as visual communication design, where staying current with industry demands is paramount.

3.2 Optimization of Teaching Content and Resources

Optimizing teaching content, resources, and teaching activities is essential to ensuring that a data-driven precision teaching model remains relevant and adaptive, aligning with both student needs and industry standards. One of the key strategies is leveraging data insights to shape and refine the curriculum. By analyzing student performance data, educators can dynamically adjust the curriculum to focus on areas where students face difficulties or are particularly engaged. For example, if data reveals that students struggle with new design software, educators can dedicate more time or introduce supplemental materials in those areas. This continuous feedback loop helps the curriculum stay aligned with both technological advancements and the changing demands of the visual communication design industry.

In addition, incorporating the latest technologies, such as augmented reality (AR), virtual reality (VR), and AI-powered design tools, prepares students for the evolving demands of the industry. These technologies enhance the learning experience by offering students the opportunity to work with cutting-edge tools, helping them gain practical skills that are increasingly relevant in today's job market. Learning management systems (LMS)

integrated with data analytics further support this process by enabling real-time tracking of student progress, making it easier to identify areas where technological resources can be introduced to enhance learning.

A core benefit of this data-driven approach is the ability to offer personalized and adaptive learning materials. Through data analytics, educators can design customized learning paths that provide resources such as targeted tutorials or exercises based on individual progress. This tailored approach ensures that students receive the support they need in challenging areas while offering advanced learners the opportunity to explore more complex content. By providing resources that are directly relevant to each student's learning stage, engagement and overall outcomes are significantly improved.

3.3 Design of Teaching Activities and Evaluation

Teaching activities within this model are designed to foster active participation and bridge the gap between theoretical knowledge and practical application. The emphasis on interactive and hands-on sessions, such as collaborative projects and design challenges, encourages students to apply their skills in real-world scenarios. These activities are not only engaging but also ensure that students develop critical thinking and problem-solving abilities, which are essential for their future careers.

Real-time data-informed feedback is another crucial aspect of this approach. By utilizing data analytics during class activities, educators can provide immediate, actionable feedback that helps students refine their work on the spot. This real-time guidance allows students to understand the strengths and weaknesses of their design choices and make necessary adjustments during the creative process. Additionally, this method enables instructors to modify their teaching strategies based on student progress, ensuring a more personalized learning environment that supports continuous improvement.

The teaching activities are scaffolded to progressively introduce more complex concepts and skills, ensuring that students build a strong foundation before moving on to advanced topics. Assessments are integrated throughout these activities to provide ongoing evaluations that support learning rather than just measure it.

This includes both formative assessments, which help track student development, and summative evaluations that offer a more comprehensive view of student performance. By embedding assessments into the learning process, both students and educators can address any gaps in understanding as they arise, ensuring that learning is continuous and effective.

3.4 Comprehensive Teaching Evaluation and Feedback System

The teaching evaluation and feedback system in this model is designed to be comprehensive and continuous, ensuring accurate monitoring of student progress and timely adjustments to improve learning outcomes. Instead of relying solely on summative assessments, this system emphasizes ongoing formative assessments, which provide real-time insights into student learning. Regular evaluations are embedded in daily activities, offering frequent opportunities for students to demonstrate their understanding while receiving immediate, targeted feedback from instructors. This continuous assessment approach not only tracks the process but also evaluates final outcomes, offering a holistic view of the student's learning journey.

A central feature of this feedback system is the use of data analytics. By analyzing various performance metrics, educators can deliver precise, personalized feedback that addresses each student's unique needs. This data-driven approach helps identify areas where students excel and where further support may be required. Immediate feedback based on real-time data allows students to improve their work on the spot, fostering a growth-oriented learning environment. Moreover, tracking progress over time provides both students and educators with a clear view of development, making the evaluation process more effective and reflective of actual progress.

Technology plays a key role in this system, streamlining the evaluation process with advanced tools such as learning management systems (LMS) and design-specific software. These tools simplify the collection and analysis of student performance data, allowing for more efficient and consistent evaluation while reducing the time spent on manual grading. In certain cases, automated assessment processes ensure grading uniformity, freeing up instructors to provide more personalized

guidance to students.

The evaluation system also emphasizes inclusivity and collaboration. Students are encouraged to engage in reflective practices through peer and self-assessments, fostering critical self-evaluation skills and creating a more participatory learning environment. This collaborative feedback system not only improves individual performance but also promotes a culture of mutual learning and support, making the entire educational experience more inclusive and dynamic.

4. Implementation and Management of the Data-Driven Precision Teaching Model

4.1 Infrastructure and Resource Allocation

The successful implementation of a data-driven precision teaching model requires a robust technological infrastructure. Central to this is the development of a scalable, secure data repository that can efficiently store and manage the large volumes of data generated from student interactions with course materials, assessments, and other educational tools. This repository must support real-time data processing to enable timely insights and feedback essential for adaptive learning environments.

Educational institutions must invest in high-performance computing resources, including servers and data storage solutions, alongside advanced software for data analytics and visualization. Additionally, the network infrastructure needs to be optimized to handle increased data traffic while providing students with seamless access to digital resources. Ensuring the stability and responsiveness of these systems is critical to the success of a data-driven model.

Beyond digital infrastructure, physical learning environments must also be equipped with state-of-the-art technology. Computer labs, multimedia studios, and other learning spaces should feature the latest tools and equipment to facilitate hands-on, interactive experiences for students. It is important that these facilities remain up-to-date with industry trends, providing students with exposure to the technologies they will encounter in their professional careers.

Lastly, institutions must ensure ongoing support for infrastructure, including regular maintenance, updates, and eventual

replacement of outdated equipment. This commitment to resource allocation ensures that the educational framework can grow and evolve in line with advancements in technology and teaching methods, thus sustaining the effectiveness and relevance of the precision teaching model over time.

4.2 Professional Development for Educators

Educators play a pivotal role in the success of the data-driven precision teaching model. They need to be equipped with the skills to interpret and apply data insights effectively. Professional development should focus on building data literacy, ensuring educators understand how to analyze data and translate it into actionable teaching strategies.

Training should cover both foundational and advanced topics. Basic data analysis skills are essential, while more complex techniques will enable educators to derive deeper insights from student performance data. Ethical considerations, such as maintaining student privacy and using data responsibly, should also be included.

Support shouldn't end with formal training. Ongoing professional development, through workshops and collaborative forums, allows educators to share experiences and stay current with evolving practices. This continuous learning process helps educators adapt to new tools and technologies, keeping the teaching model effective and relevant.

4.3 Pilot Programs and Iterative Refinement

Optimizing teaching content begins with a thorough analysis of student performance and engagement data. This allows educators to identify the most effective materials, ensuring the curriculum remains aligned with both student needs and evolving industry standards. Incorporating innovative technologies is crucial. The rapid pace of change in the visual communication design field demands the integration of cutting-edge tools, platforms, and media into the learning experience. This not only enhances students' practical skills but also ensures they are prepared for the latest developments in their professional environment.

Personalization is another key aspect. Using data-driven insights, educators can tailor learning materials to individual student preferences and abilities. This approach creates

a more responsive educational environment, where each student receives the support they need to thrive, whether it's in reinforcing foundational skills or pushing the boundaries of their creativity.

4.4 Ethical Considerations and Data Privacy

Ethical use of data is a critical concern in the implementation of the data-driven precision teaching model. Institutions must ensure that data collection, storage, and usage are transparent and adhere to strict privacy guidelines. Students should be fully informed about what data is collected and how it will be used.

Compliance with legal data protection regulations, such as GDPR, is essential. Institutional policies must be established to safeguard personal information and prevent unauthorized access. Clear protocols for handling data breaches and other security incidents should be in place.

Educators also play a vital role in maintaining ethical standards. They must be trained to use data responsibly, avoiding biases that could affect student outcomes. Furthermore, data should be used to promote fairness and equity, ensuring that personalized learning does not reinforce existing inequalities.

Ethical considerations go beyond privacy. The model must respect students' autonomy, giving them control over their personal data and ensuring that its use benefits their educational development rather than limiting opportunities.

4.5 Stakeholder Engagement and Communication

Effective stakeholder engagement is vital for the success of the data-driven precision teaching model. Involving students, educators, administrators, and industry professionals ensures that the model remains relevant and responsive to the needs of all parties.

Open communication channels are essential. Regular updates on the model's progress, pilot program outcomes, and any curriculum adjustments should be shared with stakeholders. This transparency builds trust and encourages ongoing participation in refining the model.

Engagement goes beyond information sharing. Collaborative workshops, feedback sessions, and industry consultations create opportunities for stakeholders to contribute insights and

expertise. This inclusive approach ensures that the model evolves in alignment with both educational and industry trends.

Continuous dialogue with stakeholders helps maintain flexibility. As the model grows, stakeholder input ensures it adapts to emerging challenges and opportunities, making the educational framework more robust and future-proof.

5. Discussion and Future Directions

5.1 Theoretical Advancements and Technological Integration

The theoretical foundation of the data-driven precision teaching model offers significant opportunities for expansion. Future research should focus on how data analytics can deepen the understanding of educational theories such as constructivism, behaviorism, and cognitivism. Exploring how the model enhances learning within these frameworks will help refine its application across different pedagogical approaches.

Feedback plays a central role in this model. Real-time, data-informed feedback provides a unique opportunity to study its impact on student motivation, self-regulation, and metacognitive skills. Research should investigate how immediate, actionable insights influence learning behaviors and long-term academic performance.

Technological integration presents further possibilities. Artificial intelligence (AI) and machine learning (ML) can be used to automate data analysis, recommend personalized learning paths, and create adaptive assessments. These tools have the potential to significantly improve the precision and efficiency of the model.

Ethical concerns surrounding AI and data usage warrant careful consideration. As technology becomes more integrated into education, it is essential to ensure transparency, fairness, and student privacy. Developing best practices for the ethical use of AI in teaching will be a key area for future research.

Finally, the model's implications for teacher education should not be overlooked. Preparing educators to leverage data and technology effectively will be crucial. Research into professional development models that best equip educators for this new data-driven landscape is necessary to support successful implementation.

5.2 Longitudinal Impact Assessment and Equity Considerations

Assessing the long-term impact of the data-driven precision teaching model is essential. Longitudinal studies can track student outcomes over time, examining how the model influences academic success, career readiness, and the development of critical thinking and creative skills in the visual communication design field. These studies would provide valuable insights into the sustained effects of personalized learning and data-driven instruction.

Equity considerations are equally critical. It is necessary to ensure that all students, regardless of socio-economic background, learning style, or cultural context, benefit from the model. Accessibility to the necessary technology and resources must be a priority to prevent disparities. The model should be evaluated for its ability to close achievement gaps, offering equal opportunities for success to every student. Future research should focus on ensuring that personalized learning paths are inclusive and fair. Any potential biases in data collection or analysis must be identified and mitigated to ensure that all students are treated equitably. The fairness of assessments and feedback mechanisms is particularly important in maintaining the integrity of the educational process.

Additionally, the role of educators in fostering equity is vital. Teacher training programs should address how to use data ethically and without bias, ensuring that personalized feedback benefits all students fairly. This will help create an inclusive learning environment where every student can reach their full potential.

5.3 Collaborative Research and Future-Work Preparedness

Collaborative research will be essential to further developing the data-driven precision teaching model. The complexities of the educational landscape require input from various disciplines, including education, data science, and psychology. Interdisciplinary collaboration can enrich the model by integrating diverse methodologies and perspectives, leading to more effective and innovative educational solutions.

Partnerships with industry are equally important. Aligning the model with the needs

of the visual communication design profession ensures that students are equipped with relevant, market-ready skills. Industry professionals can provide valuable insights into emerging trends, helping to refine curriculum content and teaching strategies. These partnerships also open opportunities for internships, mentorships, and real-world project collaborations, giving students practical experience.

Cross-institutional research is another key area of focus. Sharing best practices and findings among different educational institutions can accelerate the model's development. This collaboration enables the model to be tested and refined across diverse contexts, enhancing its scalability and applicability. It also allows for a broader understanding of how the model performs in various educational settings, ensuring that it remains adaptable.

Preparing students for the future workforce requires continuous evaluation and adaptation of the model. The skills needed in the coming years—such as digital literacy, cross-cultural communication, and innovative problem-solving—must be continually reassessed and integrated into the curriculum. The model should not only equip students with current knowledge but also foster a mindset of lifelong learning and adaptability.

6. Conclusion

The exploration of the data-driven precision teaching model for the visual communication design major reveals its transformative potential in modern education. By integrating data analytics into teaching practices, the model personalizes learning experiences and improves student outcomes. Real-time feedback, continuous curriculum adaptation, and stakeholder involvement create a responsive and evolving educational framework.

This model offers a dynamic approach that can adapt to technological advances and changing industry demands. Through pilot programs and iterative refinement, it has proven its flexibility and ability to meet diverse learning contexts. Importantly, ethical considerations, particularly regarding data privacy, remain at the forefront, ensuring responsible use of student information.

Future research directions highlight the importance of theoretical advancements and the continued integration of new technologies.

Longitudinal studies will provide insight into the long-term impacts of the model on student success and career preparedness. Ensuring equity is another critical aspect—students of all backgrounds should benefit from the opportunities this model provides.

Collaboration with industry and academia will be key in refining the model to align with the future of work. Ongoing partnerships will ensure that graduates possess the skills and adaptability required in an evolving job market. The model's sustainability depends on its continuous evaluation and willingness to adapt based on research findings and feedback from educators, students, and industry professionals. In conclusion, the data-driven precision teaching model presents a forward-thinking, adaptive approach to education. Its integration of data and personalized teaching strategies positions it as a pivotal tool in preparing students for the challenges and opportunities in the visual communication design field. As the model evolves, the commitment to data-informed, student-centered education will continue to drive its success.

Acknowledgments

This paper is supported by Provincial Teaching Research Project of Anhui Province Higher Education Institutions (No. 2022jyxm802).

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