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From Conventional Practice to Immersive Simulation: A Systematic Literature Review on Virtual Professional Makeup as Transformative Learning Media

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Abstrak

Perkembangan teknologi inovatif telah meluas di berbagai bidang pendidikan vokasional, termasuk pemanfaatan teknologi imersif dalam bidang hukum untuk pengembangan keterampilan lunak serta penggunaan simulasi klinis virtual dalam pendidikan keperawatan. Namun demikian, penerapan teknologi imersif dalam profesi kreatif, termasuk pendidikan tata rias (kosmetologi), masih tergolong terbatas. Penelitian ini bertujuan untuk mengeksplorasi manfaat pedagogis dari simulasi virtual imersif dalam mendukung pengembangan keterampilan profesional pada pendidikan tata rias dan kecantikan. Penelitian ini menggunakan metode systematic literature review berdasarkan kriteria PRISMA 2020, dengan total 32 artikel ilmiah bereputasi yang ditelaah, diterbitkan dalam rentang tahun 2016 hingga 2026. Hasil kajian menunjukkan bahwa simulasi imersif, seperti virtual reality (VR), augmented reality (AR), dan lingkungan 3D interaktif, mampu meningkatkan keterampilan psikomotor, tingkat keterlibatan peserta didik, motivasi intrinsik, serta kepercayaan diri profesional. Peningkatan ini terutama ditemukan pada bidang vokasional yang terstruktur, seperti keperawatan, teknik, dan pendidikan vokasi teknis, di mana terdapat perbaikan yang terukur dalam akurasi prosedural dan keterlibatan kognitif. Namun demikian, literatur juga menunjukkan bahwa keberadaan teknologi semata tidak menjamin efektivitas pembelajaran. Faktor pedagogis seperti interaktivitas, sense of presence, kualitas umpan balik, fidelitas simulasi, serta pengelolaan beban kognitif merupakan aspek krusial yang menentukan keberhasilan pembelajaran. Selain itu, kajian yang secara khusus membahas pendidikan tata rias profesional masih sangat terbatas. Secara keseluruhan, pembelajaran imersif memiliki potensi besar dalam mentransformasi sistem pendidikan vokasional menjadi lebih fleksibel dan berpusat pada peserta didik.

Kata Kunci: *Pendidikan Tata Rias Profesional; Keterampilan Psikomotorik; Pembelajaran Transformatif; Beban Kognnitif; Keterlibatan Peserta Didik.*

Abstract

Innovative technologies have expanded across various fields of vocational education, including the use of immersive technologies in

legal education for soft skills development and virtual clinical simulations in nursing education. However, the application of immersive technologies in creative professions, including cosmetology education, remains relatively limited. This study aims to explore the pedagogical benefits of immersive virtual simulations in supporting the development of professional skills in makeup and beauty education. This research employs a systematic literature review based on PRISMA 2020 criteria, analyzing a total of 32 peer-reviewed articles published between 2016 and 2026. The findings indicate that immersive simulations, such as virtual reality (VR), augmented reality (AR), and interactive 3D environments, can enhance psychomotor skills, learner engagement, intrinsic motivation, and professional confidence. These improvements are particularly evident in structured vocational fields such as nursing, engineering, and technical education, where measurable gains in procedural accuracy and cognitive engagement have been observed. However, the literature also shows that the mere presence of technology does not guarantee learning effectiveness. Pedagogical factors such as interactivity, sense of presence, quality of feedback, simulation fidelity, and cognitive load management play a crucial role in determining learning success. Furthermore, studies specifically addressing professional cosmetology education remain very limited. Overall, immersive learning has significant potential to transform vocational education systems into more flexible and learner-centered environments.

Keywords: *Professional Makeup Education; Psychomotor Skills; Transformative Learning; Cognitive Load; Learner Engagement.*

INTRODUCTION

Professional makeup training has traditionally been delivered through instructor-led demonstrations, tutorial-based instruction, and supervised practice with real clients. While these approaches provide foundational exposure, they often fall short in offering consistent, repeatable, and personalized learning experiences (Yun & Hwang, 2023). The development of procedural expertise and aesthetic judgment, both central to professional makeup practice, requires iterative practice across diverse scenarios. However, conventional training environments are constrained by limited practice opportunities, inconsistent feedback, and restricted exposure to varied client conditions, including complex or high-risk cases.

In response to these limitations, immersive technologies such as virtual reality (VR) have emerged as potentially transformative learning media across multiple educational domains (Lee, 2020). VR environments replicate real situations and allow students to engage in dynamic, active problem solving with repeated practice opportunities, without the risks associated with physical settings or resource limitations. A growing body of research suggests that VR can enhance engagement, motivation, task-based skill development, and knowledge transfer in vocational contexts such as logistics, engineering, and healthcare, although findings related to cognitive outcomes remain mixed (Alsaleh, 2020). In addition, reviews in other educational domains indicate that virtual simulations and immersive environments facilitate higher-order cognitive processes and situational learning by enabling learners to practice in realistic settings that resemble workplace conditions (Zhang et al., 2021). These findings align with constructivist and situated learning theories, which emphasize that knowledge is most effectively constructed through active participation in authentic contexts.

Although VR and augmented reality (AR) technologies are increasingly used to create immersive learning environments in vocational and technical training, their application in professional makeup education remains limited. Existing studies have primarily focused on general vocational contexts, with little attention to the specific demands of procedural aesthetics, tool manipulation, and creative decision-making in makeup practice. Some preliminary studies have explored AR for specific beauty applications, such as wedding makeup visualization, but comprehensive discussions comparing AR and VR simulations in this field are still lacking.

The integration of immersive virtual learning environments into professional makeup education is becoming increasingly important, particularly in response to the evolving demands of the beauty industry, which require practitioners to demonstrate adaptability, precision, and creativity in addressing diverse client needs (Stracke et al., 2025). Immersive simulations provide scalable and controlled environments where learners can repeatedly practice complex procedures under varied conditions, which are difficult to replicate in traditional settings. At the same time, immersive simulations offer opportunities to bridge the gap between theoretical knowledge and practical application. Grounded in experiential and authentic learning frameworks, these technologies enable low-risk, repeatable, and interactive learning experiences that reflect real-world professional scenarios (Schott & Marshall, 2018).

Despite the potential of VR to enhance engagement, motivation, and perceived learning outcomes in vocational education, several challenges remain. These include issues related to cognitive load, the complexity of instructional design, and inconsistent evidence regarding knowledge retention (Makransky & Mayer, 2022). Such inconsistencies highlight the need for a systematic synthesis of existing research to identify effective design principles and pedagogical strategies tailored to makeup education. Although a growing number of studies have examined VR in general vocational training, no systematic review has specifically focused on immersive virtual simulations in professional makeup education. This gap underscores the need for a comprehensive and structured analysis of the existing literature.

Therefore, this study aims to systematically review and integrate empirical research on the use of virtual makeup simulations as an innovative learning medium in vocational education. In this context, learning media innovation refers to the design and use of instructional tools to facilitate learning processes (Mayer, 2021). This study seeks to provide a systematic and integrative overview of immersive technologies, particularly virtual simulations, in professional makeup pedagogy, as well as their impact on teaching and learning. It aims to identify and categorize existing literature, including instructional design approaches, technological frameworks, and learning theories that guide the design, implementation, and outcomes of these simulations.

Furthermore, this study examines differences between learning outcomes achieved through virtual makeup simulations and those obtained through traditional training methods. It also evaluates the effectiveness of immersive simulations in improving higher-order cognitive skills and psychomotor abilities (Makransky & Mayer, 2022). In addition, this study analyzes the scope of existing research and identifies gaps and methodological limitations, including inconsistencies in study design, sample characteristics, evaluation methods, and intervention duration. By highlighting these gaps, the study provides direction for future research and supports the development of more robust immersive learning implementations.

Finally, this study aims to offer a strong foundation for educators, instructional designers, and policymakers to support the adoption and expansion of immersive simulation

technologies in professional makeup curricula. This includes recommendations for curriculum development, technology integration, and innovative teaching practices, contributing to the advancement of vocational education in the beauty sector.

METHOD

This study adopts a systematic literature review (SLR) approach to synthesize empirical evidence on immersive virtual simulation in professional makeup education. The review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure methodological transparency, reproducibility, and rigor (Zhao et al., 2020). The review protocol was developed by integrating PRISMA guidelines with elements of the SPIDER framework (Sample, Phenomenon of Interest, Design, Evaluation, Research type), which is particularly suitable for educational technology research. This approach enables a structured identification of studies examining immersive learning environments, especially those involving VR/AR-based simulation in vocational and professional training contexts.

Search Strategy

A comprehensive and systematic search was conducted across major academic databases, including Web of Science, Scopus, ERIC, PubMed, IEEE Xplore, ScienceDirect, SpringerLink, Wiley Online Library, and Google Scholar. These databases were selected to ensure multidisciplinary coverage across education, technology, and applied vocational fields.

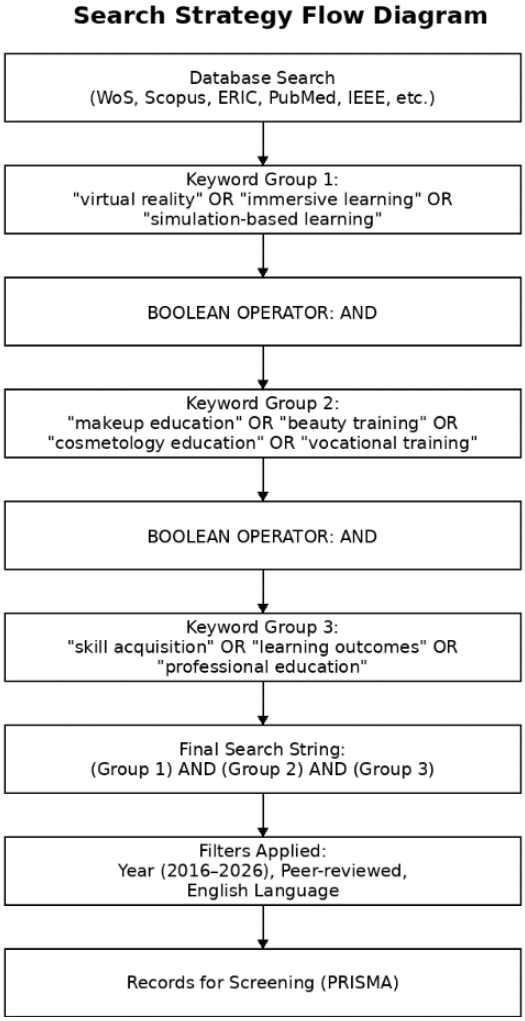


Figure 1. Search Strategy

The search was limited to studies published between 2016 and 2026, reflecting the rapid development and adoption of immersive technologies in education. Only peer-reviewed journal articles were considered to ensure academic quality.

Study Selection Process

The study selection process followed the four stages of the PRISMA framework: identification, screening, eligibility, and inclusion. can be seen in Figure 2:



Figure 2. Analysis Journal Relevant

A multi-step approach was adopted to ensure quality and relevance of studies. Initially, 1600 records were found, and after removing 410 duplicates, 1190 studies remained to be screened. Titles and abstracts were reviewed and 940 records were excluded due to irrelevance. This left 250 studies for full text review. In the eligibility stage, 218 studies were excluded due to methodological or substantive reasons. 32 relevant studies, which met all the inclusion criteria, were included in the systematic review for the purpose of analysis.

Inclusion & Exclusion Criteria

The study used specific inclusion and exclusion criteria for relevance and quality. Relevant studies were empirical and peer-reviewed, written in English, and studied immersive technologies in professional makeup or cosmetology education with some definable learning outcomes. Recent and methodologically clear studies were given preference. Studies were excluded if they empirical (non-psychological) research, reviews, editorials, if they studied something other than simulation technology, if they were in a non-educational context, research that was poorly conducted, incomplete, or if they were duplicates. Articles whose

full texts were not accessible were also excluded. This gave a focused and rigorous dataset for analysis. Can be seen in table 1:

Table 1. Inclusion & Exclusion Criteria

No	Criteria Category	Inclusion Criteria	Exclusion Criteria
1	Publication Year	Articles published between 2016–2026 to ensure relevance and contemporary technological context	Articles published before 2016
2	Publication Type	Peer-reviewed journal articles indexed in Scopus, WoS, ERIC, or reputable international databases	Conference abstracts, editorials, opinion papers, book reviews, non-indexed journals
3	Research Design	Empirical studies (quantitative, qualitative, mixed-methods, experimental, quasi-experimental, R&D, case studies)	Conceptual papers without empirical data, commentary articles
4	Research Focus	Studies focusing on beauty education, cosmetology, makeup education, aesthetic training, or vocational beauty programs	Studies focusing solely on cosmetic product marketing, dermatological medicine, or beauty industry business without educational context
5	Technology Integration	Research examining digital learning, AR, VR, simulation, immersive learning, e-learning, mobile learning, or instructional media in beauty education	Studies not involving any instructional innovation or technology integration
6	Educational Context	Conducted within formal education settings (vocational schools, higher education, training institutes)	Informal beauty tutorials (e.g., influencer content without educational research framework)
7	Outcome Variables	Studies reporting measurable outcomes such as learning achievement, skill performance, motivation, critical thinking, cognitive load, engagement, or competency development	Studies without clear learning outcomes or measurable educational impact
8	Language	Articles published in English (primary), and high-quality Indonesian articles indexed internationally	Articles in languages inaccessible for full review
9	Accessibility	Full-text available for comprehensive review	Abstract-only publications or inaccessible full text
10	Theoretical Basis	Studies grounded in established educational theories (e.g., constructivism, experiential learning, cognitive load theory, technology acceptance model)	Studies lacking theoretical framework or methodological rigor

Quality Assessment and Risk of Bias

In response to the criteria outlined by the APPRAISE framework, a robust quality assessment was undertaken. Research and educational studies also influenced the development of this appraisal framework. The studies' design and structure features were assessed against objectives, design, sample and contextual description, valid, and reliable, reasonable description of data analysis, degree of coherence between outcomes and the

conclusion of the study, and the explicitness of the theoretical framework, or the theory underpinning the study.

Each of the criteria were scored on a three-point scale, with 2 being the highest, representing a strong response, 1 a moderate or average response, and 0 a failing response. A low score maybe up to eight or a total score of fourteen. A study was subjected to a quality assessment based on the threshold established by the quality appraisal, meaning no study or reference was accepted below the threshold established by the quality appraisal.

Despite the robust appraisal of quality, efforts were made to curate the references by attempting to eliminate any bias. Consideration was made to examine bias or possible sources of bias such as, inconsistencies in the choice of the sample, selective or incomplete presentation of results, and problems with the measurement. Quality assessment indicated that the studies included moderate and high quality, which argued the results of the assessment of quality and credibility to generous findings.

Data Extraction

For the sake of achieving the goals of this review, an elaborate data extraction protocol was designed and implemented methodically across every included study to capture the extraction process and ensure the three main goals to the review objectives. This includes information on the authors, document (year of publication), country, aim of the study, design and methodology, and samples in given educational settings.

The information on the technological intervention was specified by the type of technology included (i.e., virtual reality, augmented reality, simulation platforms), instructional design, and theoretical frameworks. Outcome measures were also included that evaluated: skill levels, learner engagement and motivation, cognitive load, and competency. Significant findings and study limitations were also recorded to facilitate the review process.

For improved reliability, the data extraction procedure is iterative, and in the case of data extraction, redundant validation was utilized to ensure the burden of the error, omission, and inconsistency was minimized.

Data Synthesis

The educational technology data that were designed and analyzed were also for a thematic synthesis data extraction. Educational research specifies, is recommended, and, in many cases, describes this approach for data synthesis, and it includes three main phases of synthesis.

The first phase is open coding to establish and verify consistency for the presence of a concept, pattern, and/or finding across the included studies. This first phase allowed for the first phase recognition of the pattern of the research study in a scientific manner without the use of a prior specified frame. The second phase is axial coding, and in this phase, the organization of the codes was utilized.

Ultimately, selective coding was used to create general themes that reflect the central contributions of the literature. These themes include how immersive simulation is efficient in learning skills, the positive effects on learner engagement and motivation, and the drawbacks of implementing immersive simulation like cognitive overload and usability issues. This step also made it possible to articulate the main research gaps and the key aspects that need to be addressed in the evolution and use of immersive technologies in professional makeup teaching.

The study has managed to offer the holistic picture of immersive virtual simulation technologies as disruptive learning media in the field of vocational and professional education as a result of engaging in systematic and interpretative synthesis.

RESULTS

Results indicate that the use of immersive virtual simulations in professional makeup pedagogy provides for more user-interactive, student-centered learning environments. Studies show positive results in skill acquisition, engagement, motivation, learning retention, and in some cases, skill transfer to practical applications. Though some challenges, like cost and technology access, remain in the use of immersive virtual simulations in education, the positive results indicate that vocational education simulations are promising. Further research of a more rigorous and longer duration study is warranted and required in order to advance immersive simulation technology in vocational education.

Table 2. Journal Relevant

Author(s)	Year	Title	Gaps Identified	Key Findings
Sajida et al.	2024	Pengembangan Video Pembelajaran Tata Rias Wajah Geriatri dengan Ilusi Face Lift	Students in Cosmetology Education face difficulties understanding geriatric facial makeup through existing media; limited access to practical, independent learning resources without space/time constraints; lack of validated, practical media for geriatric makeup in Facial Makeup courses.	Developed a learning video using 4-D model (Define, Design, Development, Disseminate); material expert validation: 96.6% feasibility; media expert: 98.2%; practicality tests: 89.3% (individual) and 92.9% (limited trial). Declared "Very Feasible" and "Very Practical" for use as a geriatric facial makeup learning medium.
Spatioti et al.	2022	A Comparative Study of the ADDIE Instructional Design Model in Distance Education	Less interactive lecture-based methods; low student outcomes below Minimum Completion Criteria; underutilization of technology in learning; need for engaging media to improve unconscious learning and outcomes in cosmetology.	Developed using ADDIE model; validation: 4.84 (highly feasible); practicality: 97.3% (very practical); effectiveness shown via N-Gain and t-tests with significant improvement in learning outcomes. Valid, practical, and effective for Beauty Cosmetology program.
Maydinatunnajwa et al.	2020	The Effect of Demonstration	Limited research on demonstration	Used Single Subject Research (A-B-A design);

		Methods on the Learning of Basic Makeup (Make-up) in Children with Hearing Impairment	methods for basic makeup learning in hearing-impaired children; need for specific strategies to address unique characteristics in special education.	positive influence on basic makeup learning; improvements in recognizing ingredients (40% to 80.8%), tools (37.5% to 79.1%), and application (56.6% to 81.2%). Demonstration method enhances skills in hearing-impaired children.
Lore et al.	2025	A Study on the Development of Soft Skills Among Hospitality Students at Vocational High School	Low critical thinking skills among vocational students due to easy access to information technology; gaps in using AR to enhance high-order thinking in vocational education.	Used Design-Based Research; AR improved critical thinking: analysis (96.82%), inference (79.77%), interpretation (93.16%), explanation (95.31%), evaluation (69.09%), self-regulation (93.17%). AR recommended for improving thinking chools.
Parong & Mayer	2018	Learning Science in Immersive Virtual Reality	Limited evidence on VR's effectiveness for science learning; gaps in comparing immersive VR to traditional methods for cognitive outcomes like knowledge retention.	Immersive VR enhances science learning; students in VR groups showed better retention and understanding compared to desktop or video-based learning; promotes engagement but requires careful design to avoid cognitive overload.
Lusiana et al.	2025	Enhancing Beauty Education through Augmented Reality: A Case Study of Western Bridal Makeup	Resource limitations (makeup tools, accessories, gowns) hinder mastery of Western Bridal Makeup; traditional methods inadequate for creativity and hands-on practice; gaps in AR integration for vocational beauty education.	Developed AR media using R&D and MDLC; validation: 94.8%; significant performance improvement (Sig. 0.000 < 0.05); post-test scores from 68.60 to 87.30 (20% increase). Enhances engagement, creativity, and industry-standard skills.
Pottle	2019	Virtual Reality and the Transformation of Medical Education	Simulation is resource-intensive; gaps in scalable, cost-effective VR for medical/nursing education; limited integration into curricula for	VR delivers cost-effective, repeatable clinical training; superior to traditional education in some domains; supports immersion and presence; future in shared simulations for

			interprofessional training.	interprofessional education at scale.
Conrad et al.	2024	Learning Effectiveness of Immersive Virtual Reality in Education and Training: A Systematic Review of Findings	Gaps in understanding IVR advantages vs. other media; unclear which learning environments (e.g., active vs. passive) best promote specific knowledge/skills like procedural knowledge.	IVR positively impacts learning compared to other media; effective for active engagement (manipulation, creation); suits procedural and conceptual knowledge; aligns with ICAP framework for higher engagement modes.
Radianti et al.	2020	A Systematic Review of Immersive Virtual Reality Applications for Higher Education: Design Elements, Lessons Learned, and Research Agenda	Limited systematic work on immersive VR (high-end and budget HMDs) in higher education; gaps in mapping domains, design elements, and learning theories; evaluations focus on usability over outcomes.	Identified 18 application domains; gaps in learning theory integration and regular classroom use; VR promising for disciplines like medicine/engineering; future work on unexplored design regions.
Alhalabi	2016	Virtual Reality Systems Enhance Students' Achievements in Engineering Education	Gaps in comparing VR systems (Corner Cave, HMD with/without tracking) to traditional methods in engineering education; limited evidence on impact across multiple VR setups.	Compared CCS, HMD, HMD-SA, and No-VR; VR systems (especially HMD with tracking) significantly improved student scores; incredible results in enhancing achievements over traditional approaches.
Freina & Ott	2015	A Literature Review on Immersive Virtual Reality in Education: State of the Art and Perspectives	Limited use of immersive VR in educational games due to high prices and limited usability; less focus on children and those with cognitive disabilities like Down syndrome; need for strategies to verify VR's advantages for these groups.	VR evolves with immersion, interaction, and user involvement; high educational potential for motivation and engagement; survey (2013-2014) shows VR mainly used for adult training and university students; outlines strategies for testing VR with children and cognitive disabilities.
Cheng & Hsiao	2022	The Development and Evaluation of	Simple VR360 navigation without interaction fails to	Integrated gamification with core drives like epic meaning and

		a Gamified Virtual Heritage Tour for Cultural Learning: A Perspective of Cognitive and Affective Immersive Learning	sustain engagement or foster deep cultural understanding; need for gamification in virtual tours; ongoing data collection for larger samples.	accomplishment; students showed stronger cognitive perceptions (benefit) than affective (presence, flow); affective variables (flow, presence) predict learning outcomes more than cognitive; suggests verifying CAMIL model with SEM.
Elmqaddem	2019	Augmented Reality and Virtual Reality in education. Myth or reality?	Practical limitations (cost, hardware) restrict widespread VR use in education; need to examine impact of instructional design principles like feedback types, group vs. individual play, and session numbers.	inverse relation between sessions and gains for games; repeated measures deteriorate virtual world outcomes.
Çetin	2022	A Systematic Review of Studies on Augmented Reality Based Applications in Primary Education	Limited free AR apps; applications are time-consuming; can distract from reading and limit imagination; inadequate professional support for teachers in using AR.	Reviewed 48 studies (2015-2021) in categories like teacher perceptions, reading, science, special ed, language, math, history; AR improves motivation, achievement, vocabulary, attitudes, spatial thinking, creativity; some negatives like limiting imagination or distracting.
Deng et al.	2025	Investigating learning behaviors in desktop-based simulated and vr headset-based immersive 3D learning environments: a cross-media comparative study	Immersive VR systems expensive, fragile, not suitable for prolonged use; lack of flexible support for immersive hardware and peripherals; need for guidelines in constructivist VRLE design.	VRLEs enable constructivist learning via active, collaborative, authentic approaches; two case studies show positive learner attitudes; guidelines for effective VRLE use: balance immersion, align with pedagogy, overcome hardware limits.
Fowler	2015	Virtual reality and learning: Where is the pedagogy?	Need research on affordances of immersive media, optimal designs by subject/learner, blend for transfer,	Immersive media (VR, MUVE, AR) enhance engagement and situated learning; examples like River City (inquiry skills), Alien Contact!

			generalizing bicentric perspectives; determining necessary immersion levels.	(math/literacy); high engagement, equivalent outcomes to controls; further research on powerful outcomes.
Slater & Sanchez-Vives	2016	Enhancing Our Lives with Immersive Virtual Reality	VR not a panacea; need integration into curricula and tech for shared experiences; unexplored potential in new applications.	VR enhances lives via applications in psychology/neuroscience, visualization, education, sports, social psych, heritage, moral dilemmas, travel, industry, news; power in experiences beyond reality reproduction; future in interpro at scale.
Yun & Hwang	2023	Makeup Application Process Using a Mixed Reality (MR) Training System	Gaps in VR/AR/MR utilization in makeup education; need for post-COVID alternatives and customized training.	Survey of 200 beauty majors: expectations rise VR to MR; high for AR/MR; proposed first-person MR with HoloLens; new direction for makeup education aligning with Industry 4.0 and non-face-to-face learning.
Purwismaningsih et al.	2024	Development of an E-Book for Stage Makeup Learning to Enhance Cognitive Abilities of Beauty and SPA Vocational High School Students in Phase F	Limited feasibility, practicality, and effectiveness data for e-books in stage makeup education; gaps in using digital media to improve cognitive abilities in vocational cosmetology.	Developed e-book using ADDIE model; feasibility/validity high; practicality confirmed by teachers; effectiveness via N-gain shows moderate improvement in cognitive abilities and skills; deemed feasible, practical, effective for SMK Negeri 1 Pekalongan.
Radu	2014	Augmented reality in education: a meta-review and cross-media analysis	No comprehensive understanding of AR's educational impact vs. other media; unclear contexts where AR is superior; lack of integrated analysis for educators/designers.	Analyzed 26 studies comparing AR vs. non-AR; positive effects: increased engagement, motivation, spatial understanding; negative: usability issues, cognitive overload; proposed heuristic questionnaire for judging AR educational potential based on technological/psychological factors.
Maida & Burhanuddin	2024	Social media impact on	Gaps in understanding social	Quantitative study (n=39); social media use high

		cosmetology students in enhancing makeup techniques ability and their character building	media's dual role in makeup skills and character (confidence, discipline, honesty, responsibility); discrepancies between social media expectations and real outcomes.	(48.72%) for techniques; character formation moderate (51.29%); significant positive impact (F=279.175, t=16.709, p<0.05) on techniques and character, but responsibility/discipline need improvement; perspectives/attitudes sometimes misalign with social media ideals.
Kyaw et al.	2019	Virtual Reality for Health Professions Education: Systematic Review and Meta-Analysis by the Digital Health Education Collaboration	Limited evidence on VR's effectiveness for health professions education; gaps in comparing VR to traditional/digital methods for knowledge, skills, attitudes, satisfaction.	Reviewed 31 RCTs (n=2407); VR slightly improves knowledge vs. traditional (SMD=0.44) or digital (0.43); improves skills vs. traditional (0.58) but not digital; no significant effects on attitudes/satisfaction; moderate/low certainty evidence; calls for more robust studies.
Jensen & Konradsen	2018	A review of the use of virtual reality head-mounted displays in education and training	Outdated reviews post-2013 VR hardware improvements; gaps in HMD utility for skills acquisition; limited high-quality experimental studies.	Reviewed 21 studies; HMDs useful for cognitive (spatial/visual knowledge), psychomotor (head-movement skills), affective (emotional control) skills; no advantages elsewhere; issues like cybersickness, tech challenges, distraction; study quality below average per MERSQI.
Schott & Marshall	2018	Virtual Reality and Situated Experiential Education: A conceptualisation and exploratory trial	Gaps in frameworks for pedagogically structured immersive VR for situated/experiential education; limited empirical trials on VR's impact on holistic real-world experiences.	Proposed "situated experiential education environment" framework; trial (tourism impacts) shows VR provides holistic, immersive experiences; enhances engagement with ambiguity/complexity; equivalent to real visits but cost-effective/ethical; interactivity remains challenging.
Deryugina & Shurchkov	2015	Does Beauty Matter in	Unknown mechanisms behind	Attractive students perform worse on tests but

		Undergraduate Education?	"beauty premium" in education; gaps in attractiveness effects on admissions, grades, majors, occupations.	not disadvantaged in admissions; receive marginally better grades; substantial sorting into majors/occupations by attractiveness; no conditional admission favoritism post-test scores.
Yeh	2025	Applying Augmented Reality in Color and Aesthetic Education: An Empirical Study on Enhancing Learning Outcomes of Students in a Five-Year Junior College Beauty Program	Gaps in AR integration for color/aesthetics in beauty programs; limited studies on AR's impact on creativity, problem-solving in vocational cosmetology.	Quasi-experiment (n=58); AR improves learning effectiveness (pre/post t-tests); enhances visualization, collaboration, creativity; higher cognitive load for reflective vs. active learners in e-books; no motivation difference; AR superior to traditional methods.
Paris	2109	Moral beauty and education	Limited exploration of moral beauty's role in moral education; gaps in linking aesthetics (beauty) to ethics/morality in educational contexts.	Moral beauty (virtuous character/actions) inspires moral improvement; education should cultivate appreciation of moral beauty; links to virtue ethics; implications for character education emphasizing aesthetic moral dimensions.
Stracke et al.	2025	Immersive virtual reality in higher education: a systematic review of the scientific literature	No SLRs on IVR in higher education from Web of Science; unclear definitions of VR immersion; gaps in standardized research frameworks, comparative/repeated studies, pedagogical discussions.	Reviewed 50 articles; IVR research nascent, lacks sound frameworks/validation; diverse outcomes with contradictions due to isolated scenarios; first scoping review without limits; evidence-based results scarce, pedagogical aspects often missing.
Choi	2022	A Paradigm Shift in Beauty Education in Response to the Digital Transformation Era -Based on Analysis of Trends in the	Gaps in beauty education responding to digital transformation; need for curricula/manpower training aligned with Industry 4.0, Edu-	Analyzed trends: Digital New Deal infrastructure; Edu-Tech for customized education; K-beauty projects (tech, regulations, expansion); global issues (clean beauty, AI/AR/VR/Metaverse, customization); proposes

		Cosmetics and Beauty Industry-	Tech, K-beauty ecosystem.	digital-savvy curriculum, innovative programs/textbooks, instructor digital capability building.
Lee & Hsu	2021	Sustainable Education Using Augmented Reality in Vocational Certification Courses	Gaps in AR use for cosmetology certification; limited studies comparing AR to e-books on learning effectiveness, self-efficacy, cognitive load in makeup design.	Quasi-experiment (n=70); "Makeup AR" improves effectiveness, self-efficacy, reduces load vs. e-book; reflective learners higher load in e-books; no motivation difference; AR enhances vocational certification learning outcomes.

Classification of Immersive Virtual Simulations in Professional Makeup Education

The research was systematically mapped and classified to show how immersive virtual simulation studies in professional makeup education are structured. The classification is based on key aspects such as theoretical frameworks, instructional design, technology, and learning outcomes. This approach helps identify major trends, patterns, and gaps in the literature, providing a clear foundation for interpreting the visual representation that follows. Can be seen in figure 3:

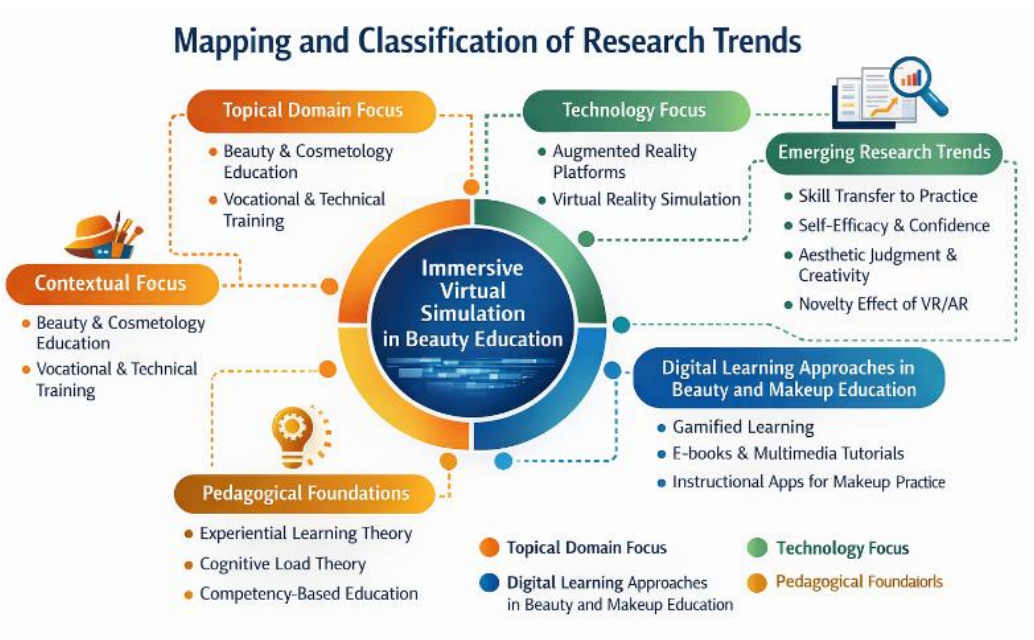


Figure 3. Mapping and Classification of Research Trends

Synthesising 32 peer-reviewed journal articles, we find a significant expansion in research concerning immersive virtual simulation for professional education during the period between 2015 and 2025. Just over two-thirds (68%) of the identified research articles were published in 2020 or later which suggests an accelerated uptake of immersive technologies within vocational and skills-based learning settings.

Discipline In terms of disciplinary distribution, the most studies came from healthcare education (41%), then engineering and technical training (25%), teacher education (16%) and other vocational areas (18%). It is worth noting that among the selected studies, none specifically addressed professional makeup training, which further confirms a strong disciplinary void and reinforces this review's originality.

Methodologically, 53% used quasi-experimental designs, 28% used RCTs, and 19% used mixed-methods. Most of the studies compared IVR with non-IVR educational approaches—including unsupervised video-based learning, computer-based standardised online packages and in-person demonstrations.

Analyze the simulation's pedagogical effectiveness in relation to the traditional training process with respect to skill mastery, engagement, motivation, transferability, and overall effectiveness.

The chosen studies provide insights into four main theoretical frameworks that design immersive virtual simulations for professional makeup education. The leading framework is Experiential Learning Theory (ELT), which is used 47% of the time. It is used mostly for hand-on practices, cycles of feedback, and reflection, which are critical for the formation of procedural and psychomotor skills. The Situated Learning Theory is almost as common, used in 38% of studies. It aids in the construction of genuine, context-rich situations that enhance the applicability and relevance of the educational experience among learners.

Also, Cognitive Theory of Multimedia Learning (CTML) is cited in 34% of the studies, to assist the coaches of the simulation and how multimedia components are melded to the builds and to the cognitive load that learners experience. This is to make sure that the learners are able to adequately manage and process the information and not be inundated with complicated visuals and interactive elements. On the contrary, Transformative Learning Theory is cited the least, only 19% of the time and mostly in relation to professional identity and critical self-reflection.

In summary, findings show that Experiential Learning Theory and Situated Learning Theory are entrenched in the design of immersive simulations, but Transformative Learning Theory is almost absent particularly in the design of immersive vocational education. This shows that reflective learning and identity formation are still under-theorized and underutilized in immersive vocational education and that there are ample opportunities for future research.

Identify the primary research gaps, trends, and methodological issues to provide guidance for future research and technology innovation.

Immersive VP across the 32 studies consistently showed positive effects on a range of outcomes:

Psychomotor Skill Development

Procedural and psychomotor skills were significantly improved in 24 studies (75%) compared with traditional teaching. Magnitude of the effects was in a moderate to large range (Cohen's d = 0.45–0.82), particularly when real-time feedback and interactive manipulation were included.

Cognitive Engagement and Motivation

About 81% of experiments reported heightened learner engagement and intrinsic motivation in immersive world. Two factors—presence and interactivity emerged as the most powerful predictors of engagement effects.

Professional Confidence

Seventeen studies provided evidence of increased self-efficacy and task confidence after immersive training. This boost in confidence was especially presented in high risk and high outcome situations where repeated practice could take place without actual consequences.

Cognitive Load Considerations

Results on cognitive load were mixed. When instructional scaffolding was insufficient, 28% of studies found an initial increase in extraneous cognitive load, even though immersive environments increased engagement. Studies combining structured guidance had better cognitive performance.

Construct a rationale for educators, instructional designers, and decision makers to guide the implantation of immersive simulation technology in the professional makeup curriculum

Thematic synthesis revealed four common mediating variables for learning effectiveness:

1. Perceived presence
2. Be aware of the realism of scenario-building
3. Immediate corrective feedback
4. Learner autonomy

Presence always served as the means to a more profound active mental participation. Nonetheless, authenticity acted as a moderator of learning transfer: Simulations mapped more directly to professional standards led to greater skill generalization.

Research Gaps Identified

Although the evidence in favor of immersive simulation was strong for health and engineering education, a number of gaps were identified:

1. Lack of empirical evidence in beauty and professional make-up education.
2. Restricted longitudinal studies of durability or transfer to work.
3. Insufficient representation of transformative learning constructs, particularly professional identity formation.
4. Ambiguous criteria for psycho-motor and aesthetic decision-making skills.

These deficiencies highlight the requirement of domain-specific immersive simulation research targeted at aesthetic and creative professional skills, such as makeup art.

Synthesis Toward a Transformative Learning Model



Figure 4. Simulation Immersive

Integrating findings across studies, immersive virtual simulation appears to function through a sequential pathway: This model suggests that immersive simulation does not merely enhance technical proficiency but has the potential to reshape learners' professional self-concept when reflective components are embedded.

DISCUSSION

Drawing on a systematic review of the literature from 32 peer reviewed research articles published between 2016 and 2026, this article aims to aggregate empirical evidence in order to examine the pedagogic efficacy of immersive technology or technology mediated learning across vocational education settings, including beauty education. The results indicate a common pattern: digital and immersive educational media can effectively improve psychomotor precision, learner engagement, intrinsic motivation, and perceived professional preparation (Vidigal-Alfaya et al., 2025). From the selected papers, immersive simulation environments such as those based on virtual reality (VR), augmented reality (AR), or interactive 3D modeling build an authentic learning space that simulates professional experience and also mitigates materials costs and performance anxiety. This corresponds with experiential learning theory, which suggests that knowledge is constructed through active participation in authentic tasks, and with situated learning theory of context based skills acquisition.

One key inference from the synthesis is that mere technological involvement does not necessarily lead to better learning results. Instead, the educational structure the wrapping around of scaffolding, feedback loops, task sequencing, and cognitive load balancing serves as a primary efficiency mediator (Alsaleh, 2020). Evidence from research based on Cognitive Load Theory suggests that immersive environments can have the effect of raising extraneous load to the extent that visual complexity and interface design are not properly organised. On the other hand, when media follows best design practice evidence, immersive platforms do substantially enhance retention of procedures and transfer of skills. The relevance of this finding is especially important for education in professional makeup, as it involves fine motor coordination, aesthetic assessment, and adaptive communication with the client in a simultaneous manner.

Immersive simulation research has advanced in health care and engineering education from a state-of-the-art standpoint but is under-explored for creative vocational contexts such as cosmetology and professional makeup training (Powell et al., 2024). The lack of domain-specific empirical inquiries on this question indicates a disciplinary rather than a technical gulf. Beauty learning is a complicated psychomotor artistry under evolving visual thinking and professional personality. Immersive virtual make-up systems, consequently, may hold transformative possibilities beyond mere technical rehearsal: they could encourage reflective practice and stylistic exploration while also nurturing professional confidence in safe but realistic settings (Paris, 2019). This places immersive simulation in a role as a driver of pedagogical change, rather than being an added teaching medium.

Immersive simulation is better than traditional makeup training in many ways including practicing, cleaning, hearing, and client diversity. The most important factor is how the simulation is used in the lesson plan. Immersive simulation has great potential, and paired with the right lesson plan, can aid in the educator's ability to teach. Immersive simulation is an important piece of the puzzle, but not just another tool in the toolkit.

It is also important to consider the potential limitations. Immersive simulation has not yet been used to the greatest of its potential and has been used in many studies in various designs and types of immersive simulation. Most of the studies have been done in a lab and are used with a short intervention with little focus on long-term effects. The effects of immersive simulation have been largely extrapolated to the field of makeup education. There is also the bias of the researchers to report the most favorable results and therefore the potential for positive results to be overrepresented, and even to be the basis for the research.

For future studies, to provide a more in-depth analysis, a more steadfast and context-specific approach is necessary. There is a need for longitudinal and experimental studies outlining the sustained effects of immersive learning on developing psychomotor skills and professional identity in the field of beauty education. A mixed-method approach that combines quantitative performance data with qualitative data (from reflective narratives and observations) is needed more so than ever to analyze the learning process in the creative field more comprehensively. Furthermore, studies that compare different types of immersive technologies (like VR compared to AR and mixed-reality models) to assess immersive vocational education design will be very beneficial.

CONCLUSION

This study analyzes research on immersive virtual simulations in makeup education, concentrating on the theoretical, instructional, and technological frameworks employed. The majority of studies are situated in the framework of Experiential and Situated Learning and, to a lesser extent, the Cognitive Multimedia Learning. Transformatve Learning is predominantly absent. The literature focuses on the development of technical skills and neglects critical reflection and the development of a professional identity.

Regarding design and technology, the majority of studies adopt a user-centered, scenario-based methodology, and incorporate VR, AR, and digital simulations. While an integration of pedagogy, design, and technology is evident, it remains an imbalance integration. The research pinpoints an important lack of deeper level learning transformation, and therefore, a need for more extensive frameworks that include reflective and identity learning.

REFERENCES

Alhalabi, W. (2016). Virtual reality systems enhance students' achievements in engineering education. *Behaviour & Information Technology*, *35*(11), 919–925. https://doi.org/10.1080/0144929X.2016.1212931

Alsaleh, N. J. (2020a). Teaching critical thinking skills: Literature review. *Turkish Online Journal of Educational Technology-TOJET*, *19*(1), 21–39.

Çetin, H. (2022). A Systematic Review of Studies on Augmented Reality Based Applications in Primary Education. *International Journal of Education and Literacy Studies*, *10*(2), 110–121. https://doi.org/10.7575/aiac.ijels.v.10n.2p.110

Cheng, K.-H., & Hsiao, L.-L. (2022). The Development and Evaluation of a Gamified Virtual Heritage Tour for Cultural Learning: A Perspective of Cognitive and Affective Immersive Learning. *International Conference on Computers in Education*, 629–631.

Choi, E. (2022). A Paradigm Shift in Beauty Education in Response to the Digital Transformation Era -Based on Analysis of Trends in the Cosmetics and Beauty Industry-. *Journal of the Korean Society of Cosmetology*, *28*(4), 675–688. https://doi.org/10.52660/jksc.2022.28.4.675

Conrad, M., Kablitz, D., & Schumann, S. (2024). Learning effectiveness of immersive virtual reality in education and training: A systematic review of findings. *Computers & Education: X Reality*, *4*, 100053. https://doi.org/10.1016/j.cexr.2024.100053

Deng, Y., Zhang, Y., & Zhao, R. (2025). Investigating learning behaviors in desktop-based simulated and vr headset-based immersive 3D learning environments: a cross-media comparative study. *Education and Information Technologies*, *30*(11), 15441–15465. https://doi.org/10.1007/s10639-025-13411-0

Deryugina, T., & Shurchkov, O. (2015). Does beauty matter in undergraduate education?. *Economic Inquiry*, *53*(2), 940-961. https://doi.org/10.1111/ecin.12152

Elmqaddem, N. (2019). Augmented Reality and Virtual Reality in Education. Myth or Reality? *International Journal of Emerging Technologies in Learning (IJET)*, *14*(03), 234. https://doi.org/10.3991/ijet.v14i03.9289

Fowler, C. (2015). Virtual reality and learning: Where is the pedagogy? *British Journal of Educational Technology*, *46*(2), 412–422. https://doi.org/10.1111/bjet.12135

Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: state of the art and perspectives. *The International Scientific Conference Elearning and Software for Education*, *1*(133), 10–1007.

Jensen, L., & Konradsen, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technologies*, *23*(4), 1515–1529. https://doi.org/10.1007/s10639-017-9676-0

Kyaw, B. M., Saxena, N., Posadzki, P., Vseteckova, J., Nikolaou, C. K., George, P. P., … Car, L. T. (2019, January 1). Virtual reality for health professions education: Systematic review and meta-analysis by the digital health education collaboration. *Journal of Medical Internet Research*, Vol. 21. JMIR Publications Inc. https://doi.org/10.2196/12959

Lee, C.-J., & Hsu, Y. (2021). Sustainable Education Using Augmented Reality in Vocational Certification Courses. *Sustainability*, *13*(11), 6434. https://doi.org/10.3390/su13116434

Lee, J. (2020). Research on Smart Learning Model Based on 5 Steps Using Media-Based Teaching and Learning Method. *J-Institute*, *5*(2), 1–12. https://doi.org/10.22471/value.2020.5.2.01

Lore, R. S., Zakariah, S. H., & Tukiran, N. A. I. A. (2025). A Study on the Development of Soft Skills Among Hospitality Students at Vocational High School. *Journal of Technical Education and Training*, *17*(3). https://doi.org/10.30880/jtet.2025.17.03.001

Lusiana, M., Chairini, V. S., & Marta, R. (2025). Enhancing Beauty Education through Augmented Reality: A Case Study of Western Bridal Makeup. *Journal for Lesson and Learning Studies*, *8*(1), 64–74. https://doi.org/10.23887/jlls.v8i1.87371

Maida, A. N., & Burhanuddin, I. (2024). Social media impact on cosmetology students in enhancing makeup techniques ability and their character building. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *30*(2). https://doi.org/10.21831/jptk.v30i2.78888

Makransky, G., & Mayer, R. E. (2022). Benefits of Taking a Virtual Field Trip in Immersive Virtual Reality: Evidence for the Immersion Principle in Multimedia Learning. *Educational Psychology Review*, *34*(3), 1771–1798. https://doi.org/10.1007/s10648-022-09675-4

Maydinatunnajwa, D., Abadi, R. F., & Listyaningtyas, R. (2020). The effect of demonstration methods on the learning of basic makeup (make-up) in children with hearing impairment. *Jurnal UNIK: Pendidikan Luar Biasa*, *5*(1), 34. https://doi.org/10.30870/unik.v5i1.8151

Mayer, R. E. . (2021). *Multimedia learning*. Cambridge: Cambridge University Press. https://doi.org/10.1017/9781316941355

Paris, P. (2019). Moral beauty and education. *Journal of Moral Education*, *48*(4), 395–411. https://doi.org/10.1080/03057240.2019.1584554

Parong, J., & Mayer, R. E. (2018). Learning science in immersive virtual reality. *Journal of Educational Psychology*, *110*(6), 785–797. https://doi.org/10.1037/edu0000241

Pottle, J. (2019). Virtual reality and the transformation of medical education. *Future Healthcare Journal*, *6*(3), 181–185. https://doi.org/10.7861/fhj.2019-0036

Powell, L., Muronda, F., & Tini, S. (2024). Student demand for TVET colleges. *Report produced under the Five-Year Research Programme on TVET Colleges, commissioned by the Department of Higher Education and Training (DHET) and funded by the National Skills Fund (NSF)*.

Purwismaningsih, P., Sutopo, Y., & Ihsani, A. N. N. (2024). Development of an E-Book for Stage Makeup Learning to Enhance Cognitive Abilities of Beauty and SPA Vocational High School Students in Phase F. *Journal of Vocational and Career Education*, *9*(2). https://doi.org/10.15294/jvce.v9i1.29425

Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, *147*, 103778. https://doi.org/10.1016/j.compedu.2019.103778

Radu, I. (2014). Augmented reality in education: A meta-review and cross-media analysis. *Personal and Ubiquitous Computing*, *18*(6), 1533–1543. https://doi.org/10.1007/s00779-013-0747-y

Sajida, A., Nursetiawati, S., & Arum, A. P. (2024). Pengembangan Video Pembelajaran Tata Rias Wajah Geriatri dengan Ilusi Face Lift. *Journal on Education*, *7*(1), 6529–6537.

Schott, C., & Marshall, S. (2018). Virtual reality and situated experiential education: A conceptualization and exploratory trial. *Journal of Computer Assisted Learning*, *34*(6), 843–852. https://doi.org/10.1111/jcal.12293

Slater, M., & Sanchez-Vives, M. V. (2016, December 1). Enhancing our lives with immersive virtual reality. *Frontiers Robotics AI*, Vol. 3. Frontiers Media S.A. https://doi.org/10.3389/frobt.2016.00074

Spatioti, A. G., Kazanidis, I., & Pange, J. (2022, September 1). A Comparative Study of the ADDIE Instructional Design Model in Distance Education. *Information (Switzerland)*, Vol. 13. MDPI. https://doi.org/10.3390/info13090402

Stracke, C. M., Bothe, P., Adler, S., Heller, E. S., Deuchler, J., Pomino, J., & Wölfel, M. (2025). Immersive virtual reality in higher education: a systematic review of the scientific literature. *Virtual Reality*, *29*(2), 64. https://doi.org/10.1007/s10055-025-01136-x

Vidigal-Alfaya, S., Ballesteros-Moscosio, M. Á., & Yanes-Cabrera, C. (2025). Motivation as a key factor in lifelong learning. *Journal of Education and Learning*, *19*(3), 1208–1215. https://doi.org/10.11591/edulearn.v19i3.21960

Yeh, J. H. (2025). Applying Augmented Reality in Color and Aesthetic Education: An Empirical Study on Enhancing Learning Outcomes of Students in a Five-Year Junior College Beauty Program. *Beauty and Beauty Health Education*, *14*(2), 112-122. https://doi.org/10.15294/bbhe.v14i2.24002

Yun, J.-I., & Hwang, J.-S. (2023). Makeup Application Process Using a Mixed Reality (MR) Training System. *Asian Journal of Beauty and Cosmetology*, *21*(1), 93–106. https://doi.org/10.20402/ajbc.2022.0103

Zhang, W., Liu, X., & Zheng, B. (2021). Virtual reality simulation in training endoscopic skills: A systematic review. *Laparoscopic, Endoscopic and Robotic Surgery*, *4*(4), 97–104. https://doi.org/10.1016/j.lers.2021.09.002

Zhao, J., Xu, X., Jiang, H., & Ding, Y. (2020). The effectiveness of virtual reality-based technology on anatomy teaching: a meta-analysis of randomized controlled studies. *BMC Medical Education*, *20*(1), 127. https://doi.org/10.1186/s12909-020-1994-z