



# Learning graphic design in augmented reality applications

## Aprendizaje del diseño gráfico en aplicaciones de realidad aumentada

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### Abstract

Currently, in a technological social context, the discipline of Design is related to virtuality and digital communication. Design schools of higher education require creating subjects focused on design with emerging technology so that students learn to design and develop projects with technologies such as Augmented Reality (AR).

The objective of this research is to show three case studies in which intermediate and advanced level Graphic Design students learned to design augmented reality experiences through free-use applications without programming knowledge.

The methodological design of the research is qualitative with an exploratory descriptive approach, with three case studies of Graphic Design students. The results obtained were that the students acquired knowledge in the use of AR design platforms and learned to identify the design needs of a company to propose creative solutions with a technological level that professional activity demands today. The relevance of the analysis of this article is that it demonstrates the technological scope that a Graphic Design student can achieve without specific programming knowledge and without limitations when designing on a single AR platform, considering that there is now a variety of software to design and develop technological applications, which adapt to the development of skills that a Graphic Design student can acquire.

**Keywords:** Augmented reality, Graphic Design

### Resumen

Actualmente, en un contexto social tecnológico se relaciona la disciplina del Diseño con la virtualidad y la comunicación digital. las escuelas de Diseño de educación superior requieren crear materias enfocadas al diseño con tecnología emergente para que los estudiantes aprendan a diseñar y desarrollar proyectos con tecnologías como la Realidad Aumentada (RA).

El objetivo de la presente investigación es mostrar tres casos de estudio en que estudiantes de Diseño Gráfico de nivel intermedio y avanzado aprendieron a diseñar experiencias de realidad aumentada por medio de aplicaciones de libre uso sin conocimientos en programación.

El diseño metodológico de la investigación es cualitativa con enfoque exploratorio descriptivo, con tres casos de estudio de alumnos de Diseño Gráfico. Los resultados obtenidos fueron que los estudiantes adquirieron aprendizaje en el manejo de plataformas de diseño para RA y aprendieron a identificar la necesidad de diseño de una empresa para proponer soluciones creativas con un nivel tecnológico que la actividad profesional exige hoy en día. La relevancia de análisis del presente artículo es que demuestra el alcance tecnológico que un estudiante de Diseño Gráfico puede lograr sin conocimientos específicos en programación y sin limitantes al diseñar en una sola plataforma de RA, considerando que ahora existe variedad de software para diseñar y desarrollar aplicaciones tecnológicas, las cuales se adaptan al desarrollo de habilidades que puede adquirir un estudiante de Diseño Gráfico.

**Palabras clave:** Realidad aumentada, Diseño gráfico

## Introduction



Augmented reality in the teaching of Graphic Design has an impact that highlights technological evolution, as well as the benefit of learning from technological skills, as stated by Huda et al. (2021), who say: “Augmented reality is the latest evolutionary technology in an era called the digitalization era, augmented reality has proven to be effective as a learning tool” (p. 117). Likewise, Lin and Chen (2020) describe it as “a technology that superimposes dynamic digital content in a real-world environment, providing a realistic and immersive context” (p. 45690). In this sense, in the area of Graphic Design, multiple possibilities are identified to make creative design proposals, using technology as a resource. These possibilities can be applied in 3D renders visualized through AR, animation videos in QR codes, textbooks with AR application and the visualization of 3D logo prototypes. Today's technological evolution provides free design platforms to upload 3D models and display AR content. Some platforms have a free trial for a limited time, while others provide the service of generating QR codes to view AR. Below are some platforms that were identified as a means to generate AR without the need to develop a specific application. In this sense, Seidametova et al. (2021) call these platforms Software Development Kits (SDC) and claim that these platforms allow developers to create objects that appear to integrate into the real world, in addition to offering 3D object tracking, image recognition, visual search, and multi-tracking functions. Table 1 presents different SDCs that are commercially found on the Internet, as well as the type of marker they allow; in some applications it can be a designed image, while in others a QR code can be generated.

Table 1. AR Software Development Kit

RA KDS	Type	Type of marker
EasyAR	Free, comercial use	Image
Here Mobile SDK	Free, comercial use	Image
Kudan AR Engine	Free, comercial use	Image
Wikitude	Free, comercial use	Advanced
Vuforia	Free, comercial use	Advanced
Droid	Free	Image
Xloudia	Only comercial use	No marker
Catchoom	Free, comercial use	No marker
ARLab	Free, comercial use	QR CODES

Source: Adapted from Seidametova et al., 2021.

**Augmented reality**

AR is identified as a relatively new technology in the field of higher education. Applying and developing AR requires mastery and knowledge of other technologies that are outside the Graphic Design work area. For example, Vakaliuk and Pochtoviuk (2021) state that to design and develop an AR application, mastery of a video game engine is required, as well as an SDK, which are a set of development tools that allow software professionals to create applications, while Nguyen et al. (2020) claim that to design an AR application, specific tools and knowledge in software development are needed, requirements that represent an obstacle for beginners who want to create an AR experience on their own.

In this sense, if developing an AR application requires specific skills and knowledge of software development, what happens if a Graphic Design student has a design proposal in AR? A challenge arises in mastering the tools and skills necessary to make innovative proposals with this type of technology. The progress in the development of platforms to design AR is notable, since they are available through the web and in applications through cell phones. Some platforms work for free, but with limitations, while others work during trial periods. According to Marques et al. (2023), the platforms Geenee AR, Adobe Aero, PlugXR Creator, Spark

Studio, XR+, Blipparbuilder and Byldr are some of those that offer AR design features. In addition, they indicate that no-code tools allow the creation of visual metaphors capable of communicating and that their main advantage is the easy access to the creation of AR content, since it is a first approach for designers without previous experience in the design of this tool.

AR design is developed by software development professionals, as argued by Weltin et al. (2023), who claim that most of the content designed for AR is done by developers. However, AR design platforms are identified that allow content to be generated by graphic designers or digital designers, even if they do not have software development knowledge.

Below, we present background information on AR projects developed without programming codes. The project by Rodríguez-García et al. (2019) focuses on the design of AR through QR codes, with the aim of implementing it in the educational system for multicultural purposes. The work methodology was learning by doing, while the research methodology was descriptive and cross-sectional. The results were that the use of AR without the need for code can function as a learning medium and generate positive experiences for students.

On the other hand, the document by Mora Alvarado (2021) is set in the urban sector, with the aim of generating public information on housing in Ecuador. This is research with a quasi-experimental quantitative approach. The results were that the use of mobile application prototypes with AR and QR codes allow for novel experiences to support the development of smart cities.

Finally, AlNajdi's project (2022) has shown that AR has a positive impact on education, which can be seen in the different educational documents that use it, such as electronic textbooks, learning games, video clips and television channels. The project consisted of students having access to classes through QR codes during the COVID-19 pandemic, which allowed knowledge to be brought to students without them having to be in direct contact. The results were that students who integrated this technology into the learning process obtained positive results and that current students have developed skills for the use of technology.

### Project Based Learning

In this research, the Project-Based Learning (PBL) method is used with the aim of students learning to design AR for applications in the context of graphic design, which involves a step-by-step process consisting of research, exploration, design, and application. From the process, the student develops design skills, such as visual communication, design management in a technological project, and problem solving. The benefit obtained from this method is that the student explores and uses different technological platforms for AR design without applying knowledge

in programming languages, which means that the student learns to identify and use current platforms to design AR in relation to the need of a business.

PBL is a methodology that is in line with current teaching-learning trends in the higher education system. Zhang and Ma (2023) argue that it is a learning model that focuses on concepts and principles of a subject, with the help of various resources and continuous learning activities based on exploration in the real world. PBL allows the active participation of students in technological projects. Similarly, this learning method, in the words of Krajcik and Shin (2014), is based on the constructivist model in which students acquire deep learning from the application of the material and build their understanding reflected in ideas within a real-world context.

The PBL method has characteristics that distinguish it from other learning options. In the words of Markula and Aksela (2022), these are the following:

- ❖ Project driving question: The visual outcome of the project will answer the project's driving question. The driving question has a link to the real world. In the present research project, it was applied according to the question: How to respond to the design needs of a local business through AR graphic design?
- ❖ Learning goals: PBL should allow students to acquire new skills focused on the curriculum. In this sense, students learn to manage AR design platforms, as well as to identify the design needs of a business in their locality.
- ❖ Scientific practices: Students must apply scientific methods to solve and study the determining question. In preparing the project, students conduct research with questions based on AR and graphic design, as well as in relation to their way of communicating an idea to a specific group of consumers.
- ❖ Collaboration: During the development of the project through PBL, students carry out collaborative research, which can be through experts, companies or the teacher. This motivates students, models the way of working and allows the development of communication skills.
- ❖ Use of technological tools: Current scientific education must give importance to computer-assisted technology. Technology allows students to support learning through it, fostering greater interest in knowledge and application.
- ❖ Create an artifact: PBL focuses on producing an artifact. These present the cognitive work of students and their level of understanding.

The result of this research is the application of AR to solve the design need that a business or company may have.

By applying technological tools and the PBL methodology, it is possible to have positive learning results that help to understand graphic design through technology applied to specific design needs. Likewise, students acquire cognitive skills through research, observation and analysis of the importance of working from design with technology. PBL, from an educational perspective, leads to the resolution of problems focused on the real professional world.

**Study case** Next are three case studies that arise from the Digital Production course of the Graphic Design program of the Institute of Architecture, Design and Art offered at the Autonomous University of Ciudad Juárez. The characteristic of the course is that it is taught online, its activities are divided into 16 weeks of work where the student learns to use a 3D modeling tool, it is the free software called Blender and it is possible to download it from any computer that has a graphics card to run the program. The objective of the course is for the student to acquire technological skills to design in 3D, therefore, during the semester different 3D modeling activities are assigned. Some of them are: modeling a character, applying 3D text, using particles to make a visual effect and video and image renders. In this way the student identifies some of the different tools to design in 3D. Before the end of the semester, an AR project is proposed based on the needs of a company.

**Methodology** The applied research methodology is exploratory, descriptive and qualitative, since it describes the process and the technologies that the students followed to design the models, as well as the exploration of the functioning of different platforms that they used to complete the end-of-course activity.

The methodology is that of project-based learning, where the student develops a project with a technology that is unknown to him; however, the teacher proposes the different AR platforms that exist. Thus, the context of teaching design and learning 3D modeling allows for an approach to AR along with other technologies.

Currently, there are methods to design and develop an AR application with knowledge in software development. Figure 1 presents the method that the students followed to design AR based on a business where the need to implement this tool to improve internal communication of the business or with its clients was identified.

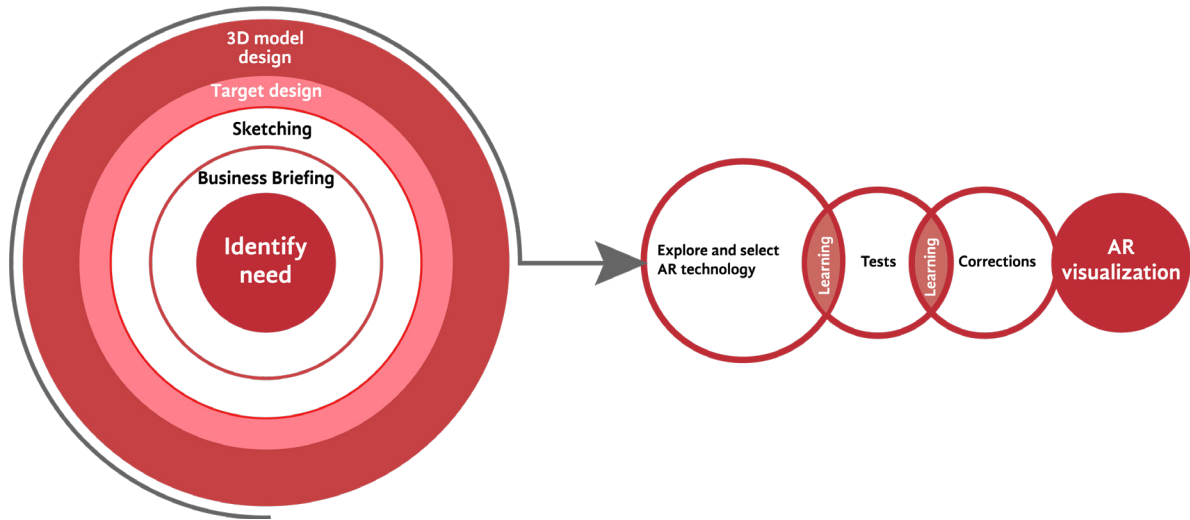


Figure 1. AR design process in the field of Digital Production.  
 Source: Own elaboration.

The project begins with the identification of the need that the business may have, then comes the business briefing layer, which is the identity design documentation that a small or medium-sized company must have. In case the business does not have it, it is necessary to do a prior corporate identity design. The sketching layer comes next and is where the first proposals are designed, this revolves around the briefing, it is about giving information such as color palette and typographic font. The information is used to make first sketch proposals that form the first stage of the final project review.

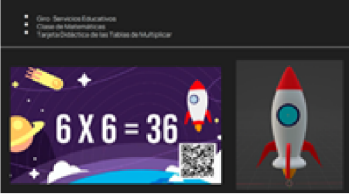

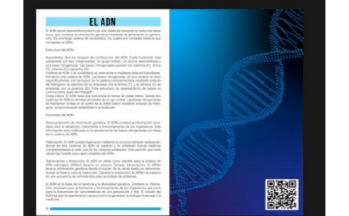
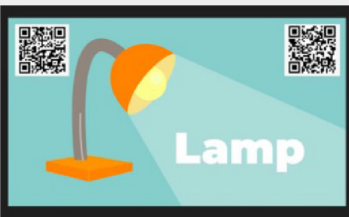
The next layer is the design of targets, in which students make 2D design proposals, which will be the means by which the scanning is done and the AR can be visualized. The targets must be related to the company's brand.

Finally, the last layer is the 3D model design, where the student puts into practice the Blender software learning and makes AR visualization proposals.

Later, the exploration and selection stage of technology in AR development platforms requires an application that does not require software development and that, in turn, is free to use. At this stage, students are offered the option of using Augment, an augmented reality platform that generates business and commercial benefits, but they can explore the uses of different platforms that allow AR design. This stage is a learning stage and allows for the identification of different requirements, formats for export, and design examples with this technology.





<p>Maths</p>		<p><a href="https://www.youtube.com/watch?v=7RcFo0WuE6g">https://www.youtube.com/watch?v=7RcFo0WuE6g</a></p>
<p>Geography</p>		
<p>ADN</p>		
<p>English class</p>		

Source: Own elaboration.



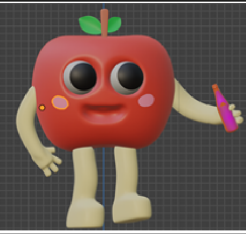
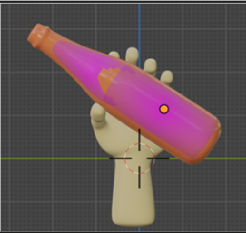

Table 2 presents the project in which the student identified the need to apply AR to education. In this regard, Garzón (2021) argues that “this technology has left a positive mark on education and that 25 years have passed since the development of the first AR application designed exclusively for use in educational environments” (p. 1).

In this way, the student identified and explored different possibilities to implement AR in the educational context, in addition to using design tools, such as the correct application of color and fonts that can be interpreted in this technology.

**Project:** California Apple Soda

**Software:** Augment

Table 3. AR applications for the case 2. Olga Alejandra Reyes Mendoza






Application of RA	Model 3D	RA video
Logo		
Sign		
Character		<p>video.aplicandoRA.mp4</p>
Hand with bottle		
Food and soda		

Source: Own elaboration.

Table 3 presents the project for the brand of an apple soda. The student drew the logo in 3D, as well as the proposal of a character alluding to the soda. She designed an experience of uses of the soda in AR, showing the product, as well as the food that is usually accompanied by it. The elements presented highlight the use of the soda brand in different formats, text, logo and character.

The result of this project is an approach to the functionality of AR in the context of marketing. Sung (2021) states that “marketing through AR can shape consumer behavior by integrating information or digital objects into individual perceptions of the physical world to support brand strategies, sales and customer service delivery” (p. 75).

Table 4. AR applications for case 3: Heidi González

Application of RA	Target	RA Video
Presentation card		LOGO RG.mp4
Sign CdJz		LOGO JRZ.mp4
Giveaway		GIVEAWAY.mp4
Stickers best selling stickers (ask for your favorite)		STICKERS.mp4
Sign of shades		TONOS.mp4

Source: Own elaboration.

The project presented in table number 4 is AR applied to a car sign and tinting business. This technology served as a means of information about the brand, as well as the different applications of the services they offer. From a retail perspective, a promising application of AR is to facilitate product evaluation, by allowing customers to experience products virtually before purchasing them, according to Tan et al. (2022). In this sense, the customer's experience with AR can help facilitate a purchasing process, as it acts as a means of communicating the product and being able to visualize it through a technological resource.

**Discussion** The projects presented as case studies offer alternatives in AR uses and applications through free platforms that can be worked on by graphic design students with knowledge and skills in color and typography management. The technological learning that served as support in the activity was 3D modeling, which is a useful resource for generating AR content.

The projects presented by the students allow observing and generating learning for those who study Design, based on the fact that the discipline of Graphic Design expands at the same speed as technological evolution. Therefore, in the interactive content that is currently designed, it is necessary to have an expert in Graphic Design, with the aim of improving the content and, in this way, enriching the visualization of AR.

As can be seen, AR can be applied in various areas of study, as argued by Montero et al. (2019), who mention that "AR technology has been applied in various areas, whether education, medicine or entertainment" (p. 49). In this way, students are given the freedom to identify a specific area of business communication with which they are going to develop the AR. In this case, three case studies were presented based on education, marketing and sales, which are areas that are highly sought after for AR design and development.

**Conclusions** The field of Graphic Design evolves positively if it develops in tandem with technology. It is necessary for Design students to know, identify and explore new technologies, as this will allow them to demonstrate their ability as designers, as well as their interest in using technology as a resource in favor of their learning and development in the workplace. It is necessary that, in the study programs of Graphic Design in universities, a subject of emerging technologies or, in this case, of immersive virtual technologies be incorporated as a means of exploration and knowledge to develop Graphic Design from a technological perspective and in trend with the workplace.

The development of the AR design project led the students along a path of research and knowledge. They began by investigating the design needs that a company could have and then moved on to a graphic design proposal as a creative and innovative result for the user. In addition, students discovered the means to design user experiences through AR, which means that they left the known area of learning and work to explore the world of AR technology, by researching technological tools that are not paid and that are learned to use thanks to an intuitive interface, also adapting to the needs of the user.

Based on the results of the research, it was determined that students acquire design skills through current interactive emerging technologies and that they have the ability to make innovative proposals for specific design needs in a company. In addition, it was shown that the proposals generated in a study subject can become thesis research, and that, on the other hand, it is possible to apply this tool in different areas of study, such as medicine, architecture and design, where technological simulation through AR is identified as a need to support the representation of objects. ●

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As a teacher-researcher, she has participated in different design and technology conferences, especially in design and virtual reality in Mexican traditions and culture. She has also developed projects together with students for their exhibition at technology fairs and cultural exhibitions. She belongs to an academic body where they have developed research seminars, project presentations and thesis direction, all within the area of emerging technologies and communication.



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