Artículos científicos

El aprendizaje servicio como una propuesta educativa del diseño industrial para la innovación social

Service Learning as an Educational Proposal of Industrial Design for Social Innovation

Aprendizagem de serviço como proposta educacional do desenho industrial para a inovação social

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Resumen

En este artículo se analizó el alcance de la innovación social desarrollada en la práctica educativa del programa académico de Diseño Industrial como una alternativa para establecer una vinculación social entre las instituciones educativas y los territorios. Para ello, se identificó la relación del aprendizaje servicio para la adquisición de la competencia de innovación social en las propuestas académicas desarrolladas por estudiantes de licenciatura. El objetivo fue describir el aprendizaje desde el servicio y la trascendencia social de proyectos académicos, así como la adquisición de competencias mediante la elaboración de alternativas viables y factibles para el desarrollo local. Metodológicamente, se empleó un estudio de caso con una aproximación de tipo etnográfica en la que se utilizaron herramientas cualitativas como la observación participante, las entrevistas, el análisis documental y los registros visuales. Los resultados demostraron el desarrollo de la práctica educativa y el papel de los actores involucrados en el proceso de aprendizaje y la adquisición de las competencias requeridas. En la discusión se explica el papel de cada uno de los componentes de la propuesta educativa y de los proyectos académicos, el aprendizaje logrado y el cumplimiento

de los objetivos educativos a través de las competencias profesionales, así como sus repercusiones en la vinculación social como parte de los propósitos del proyecto curricular y de la interacción con los actores sociales para coadyuvar en el desarrollo de los territorios, lo cual permitió establecer conclusiones y algunas recomendaciones sobre la adquisición de las competencias planteadas.

Palabras clave: competencias, diseño, proyectos académicos, vinculación social.

Abstract

This paper analyzed the scope of social innovation, developed in the educational practice of the academic program of Industrial Design, as an alternative to establishing a social link between educational institutions and territories, identifying the relationship of Learning Service for the acquisition of the social innovation competence in the academic proposals developed by undergraduate students. The objective was to describe the learning from the eservice and social significance of academic projects, as well as the acquisition of competences, by developing viable and feasible alternatives for local development. Methodologically, it was developed as a case study with an ethnographic-type approach in which qualitative tools such as participant observation, interviews, documentary analysis, and visual records were used. The results demonstrated the development of educational practices, and the role of the actors involved in the learning process and the acquisition of the required competences. The discussion explains the role of each of the components of the educational proposal and academic projects, the learning achieved and the fulfillment of educational objectives through professional competencies, as well as its repercussions on social bonding as part of the purposes of the curricular project and of the interaction with social actors to assist in the development of the territories, which allowed to establish conclusions and some recommendations regarding the acquisition of the proposed competences.

Keywords: Academic projects, competences, design, social involvement.

Resumo

Este artigo analisou o âmbito da inovação social desenvolvida na prática educacional do programa acadêmico de Desenho Industrial como alternativa para estabelecer um vínculo social entre instituições de ensino e territórios. Para tanto, identificou-se a relação entre aprendizagem em serviço para a aquisição de competência em inovação social nas propostas acadêmicas desenvolvidas por alunos de graduação. O objetivo foi descrever a aprendizagem de serviço e a importância social dos projetos acadêmicos, bem como a aquisição de competências por meio do desenvolvimento de alternativas viáveis e viáveis para o desenvolvimento local. Metodologicamente, utilizou-se um estudo de caso com abordagem etnográfica em que foram utilizadas ferramentas qualitativas como observação participante, entrevistas, análise documental e registros visuais. Os resultados demonstraram o desenvolvimento da prática educativa e o papel dos atores envolvidos no processo de aprendizagem e aquisição das competências requeridas. A discussão explica o papel de cada um dos componentes da proposta pedagógica e dos projetos acadêmicos, as aprendizagens alcançadas e o cumprimento dos objetivos educacionais por meio das competências profissionais, bem como suas repercussões no vínculo social no âmbito dos propósitos do projeto curricular e de a interação com os atores sociais para contribuir para o desenvolvimento dos territórios, o que permitiu estabelecer conclusões e algumas recomendações sobre a aquisição das competências propostas.

Palavras-chave: habilidades, design, projetos acadêmicos, vínculo social.

Introduction

In this article, the linking of higher education institutions with society is assumed as a matter of transcendental relevance, an essential aspect to promote local, regional and national development (García and Lindquist, 2020). For this, however, academic projects must be structured with consolidated strategies (Whattes, Encinas and Zarza, 2018) that promote the development of territories, container spaces of their own culture in which various goods and services are produced (Boisier, 2011) .

In this sense, the National Development Plan (PND) states that education in Mexico is "inclusive, equitable, and of quality [and seeks] to promote lifelong learning opportunities

for all" (Government of Mexico, December 30, April 2019, p. 215), a condition that is based on the Political Constitution of the United Mexican States, which establishes the following:

> Education will be based on unrestricted respect for the dignity of people with a focus on human rights and substantive equality. It will tend to harmoniously develop all the faculties of the human being and will promote in him, at the same time, love for the Homeland, respect for all rights, freedoms, a culture of peace and awareness of international solidarity, in independence and in justice, it will promote honesty, values and continuous improvement of the teaching-learning process (Cámara de Diputados, 2020, p. 5).

In accordance with this idea, Acuña (May 4, 2019) points out that the national educational system has considered the importance of higher education for the fulfillment of national purposes. In fact, the General Law of Education in Mexico establishes that "education is the fundamental means to acquire, transmit and enhance culture; and that it is a permanent process aimed at contributing to the development of the individual and the transformation of society "(Ministry of Public Education [SEP], 2018, p. 4).

Likewise, the Education Sector Program 2020-2024 published in the Official Gazette of the Federation of the Ministry of the Interior (SEGOB, July 6, 2020) determines that there must be "an education relevant to the social, economic and geographical environment of the and students, as well as inclusive in recognizing their needs, interests, rhythms and talents "(p. 1). In this sense, it is considered that education and research constitute the pillars of national development, hence the need to "promote the certification of labor competencies associated with the shortcomings of each region, such as those aimed at sustainable tourism, caring for the environment. and entrepreneurship "(SEGOB, July 6, 2020, p. 1). To achieve this, according to Zamora (2019), universities must develop competencies in students through meaningful learning experiences that involve cooperation and social interaction strategies.

For this reason, the need has arisen for a reorientation and transformation of higher education institutions to respond to the needs of their communities and the specific characteristics of their context, with specific actions and with the development of transformation projects "with full respect for university autonomy, oriented towards common objectives that link teaching, research, cultural diffusion and extension with the needs of social groups and productive sectors of all regions of the country […] to favor the inclusion with equity of historically discriminated groups "(SEGOB, July 6, 2020, p. 1). Likewise,

develop programs and actions in emerging areas to contribute to the resolution of national and regional problems incorporating technological advances, with innovations relevant to the territories, through a commitment to social service with local and regional spheres. This essential task is called by Vázquez (2019) university social responsibility, which seeks to promote academic experiences that promote the acquisition of competencies for this purpose, such as those acquired through the relationships between service-learning, a methodological proposal that "combines in a single activity the learning of contents, competences and values "(Puig, 2009, cited by Traver-Martí, Moliner and Sales, 2019, p. 197) to promote the development of academic projects inserted in real contexts.

Social contribution of the educational program of the degree in Industrial Design of the Faculty of Architecture and Design of the Autonomous University of the State of Mexico

The Autonomous University of the State of Mexico (UAEM) —one of the ten most important in the country (UniRank, 2020) - stands out in its Master Plan for Institutional Development (UAEM, 2017), in accordance with the National Development Plan and the National Education, the task of human capital formation for the transformation of the country from the factors of culture and connection with economic, social and political needs "through the actions of university students" (p. 168). Likewise, the importance of its Special Program for Science, Technology and Innovation is underlined as a perspective that proposes transferring the knowledge generated in the institution to the broad sectors of society, including public and private associations to face development sustainable.

This situation is considered a priority in the State of Mexico, since there was a considerable growth of inhabitants living in poverty, since the figures increased from 6 712 051 in 2010 to 8 054 703 in 2015 (Centro de Estudios de Public Finance, 2018). Given this condition, the Governing Plan of the UAEM (2017) indicates that the institution must face this situation of state poverty in a critical and responsible way, applying knowledge in a solidary and collaborative way with new proposals for academic organization that allow students to students develop skills for the resolution of social, regional and national problems.

> The academy of the future must provide students with tools that allow them to transcend disciplinary boundaries and constantly update their paradigms of application of knowledge, technologies, orienting the development of their

profession towards a marked trend towards innovation in solving complex problems. (UAEM, 2017, p. 161).

The foregoing from the institutional collaboration with various groups and communities that reside in the State of Mexico as a strategic objective of cooperation with local, state, federal and international entities to bring the products of science, technology and culture closer to vulnerable groups. prepared in academic and research centers (Abraham et al., 2011).

Likewise, the development of the institution's professional study plans and programs must be based on the institutional model of curricular innovation (UAEM, 2005), which defines the structure and frames the approaches for the teaching-learning process, reaching an articulation of knowledge, know-how and know-how. In this model, transversal axes are established that allow a balanced training based on the acquisition of generic, relational and open, propositional and transferable, as well as integrative skills. In order to achieve the acquisition of meaningful learning, action must be taken in conjunction with teachers to generate lines of curricular transformation focused on cultural values and proactive and innovative attitudes (Cadena, Pérez, Olmos and Santana, 2005). This from educational innovation and introducing learning situated in real contexts and service learning as a community contribution (Díaz-Barriga, 2010).

According to Díaz and Osorio (2011), the constructivism proposed in this curricular model of the UAEM (2005) is described as an image that involves the student as a subject who develops new knowledge, skills and values on a daily basis, which incorporates to your own formation or scaffolding. For the National Association of Higher Education Institutions, the production and transmission of knowledge is a strategic activity that should affect social well-being, as well as provide solutions to urgent needs of society and establish links with the productive sector in a regional context, national and international, in accordance with the plans and policies of the country (Vázquez, 2019).

In this sense, Díaz-Barriga (2010) proposes that the pedagogical guidelines should be proposed in a line beyond theorizing and rote. This means that competencies must be considered as parts of the human being's ability to adapt to contexts and respond to their needs. Thus, the educational programs developed by competencies enable the linking of students and graduates with current social conditions (Jiménez, 2018), since the recommendations of Unesco (2018) are followed to promote development at the local and international level.

According to Macías and Bribiescas (2012), it is estimated that the educational model by competencies enables observable and measurable learning, as well as a reflective and creative capacity for the construction of concepts and the resolution of social needs. A higher level educational program based on competencies must seek the adaptation of the student to their sociocultural environment, for which they must develop specific competencies according to each disciplinary field (Galdeano and Valiente, 2010). Thus, in the Latin America Tuning Project (2019) three types of competencies are described:

- Instrumental: They are the capacities, abilities and skills for oral, written and visual communication, information management for analysis and synthesis, and creativity and research.

- Interpersonal: They allow cooperation and social interaction, which enables teamwork, appreciation and respect for diversity, as well as work in diverse contexts.

- Systemic: They serve to assess the interaction of the parts with the whole, as well as to develop projects, establish ethical and quality commitments, and solve problems in an innovative way. (Jiménez, 2018).

Therefore, learning through service to society can be conceived as useful skills for the territories, hence the importance of service learning, understood as a methodology that allows defining an academic community as an agent of social change where "learning and service feed each other "(Traver-Martí, Moliner and Sales, 2019, p. 197). To identify the purposes of social bonding from this didactic resource, in the Faculty of Architecture and Design, specifically in the Educational Program of Industrial Design, some antecedents of the curricular project that support the current implementation of academic projects for territorial development are described from the design and innovation competences, particularly the social one.

The six types of specific competences that currently base its curricular proposal are pointed out, highlighting that they contain the three types of transversal competences for higher education programs in Latin America:

- Design context: For the sociocultural link and symbolic interpretation that enables the identification of problems through cultural references that allow, in the case of social projects, to relate to the various contexts or territories where they interact.

- Man-object links: To establish the anthropometric and psychological relationships of the human being.

- Project development: For the development of projects, for the configuration of three-dimensional objects and services around them that provide the basis for planning or design thinking.

- Communication and languages: For the interpretation and communication of specific languages of the disciplinary field.

- Technology and production: For the use of technologies and innovation; they involve the use of tools and machines for manufacturing, as well as for reproduction using digital media.

- Implementation: For the context of projects, as well as the development of capacities for conflict management and integration (UAEM, 2015, p. 127).

All of the above adds to the fulfillment of the following profile:

> The graduate of the Bachelor of Industrial Design of the UAEM is governed by an ethical, aesthetic and humanistic sense for the generation of three-dimensional objects and development of efficient and innovative design projects, with a sustainable approach that improve the quality of life of society (UAEM, 2015, p. 68).

The ability to generate and innovate is emphasized, as well as social ties from a social welfare approach that enables the acquisition of skills through ties with territories. The above definition is directly associated with the objectives set by the World Design Organization (WDO, 2019), which underlines the activity of designing innovative products and services and the development of social projects as a core area of the profession.

Thus, the competence of social innovation stands out in this curricular proposal as essential for the achievement of the graduation profile and the link, since innovation must incorporate the idea of welfare and social progress. Macías and Bribiescas (2012) describe the profession of industrial design as a branch of the design discipline that is responsible for the generation and production of objects and services for daily use, bearing in mind the impact that these products have on society, analyzing existing contextual conditions and modifications caused by the use of these objects or services.

This means that the improvement of socio-cultural and productivity conditions at any level for the materialization of design products is found in innovation, which is based on the

economic postulates of modernity. As Shumpeter (1977, cited by Mora and Villar, 2016) explains, it is a situation that, through creative processes, enables the development of modifications to current situations through the design of new products placed in a market, as well as the development of new materials and original processes that allow the opening of emerging markets. Then, innovation becomes a way where the generation of ideas is transferred and transformed into something new, whether it is a product, service or knowledge, which is appropriate by a company and promotes the generation of wealth and quality of life.

Therefore, service learning is considered as a link between the university and society (Batlle, 2017), which can be established as a method to incorporate knowledge and values with the actions carried out in a territory, thus enabling the building skills for the development of design projects and for the creation of new concepts and innovative project proposals. In the case of industrial design, through project work and skills for social innovation in a process of interaction and territorial vision, it is expected "to achieve that a designer elaborates innovative proposals through the knowledge of identity and the processes of meaning established in a region "(Mora and Villar, 2016, p. 19).

This type of creation relates the generation of new ideas or projects with social ties (Gurrutxaga, 2011), in correspondence with the purposes for national and regional development. Likewise, the objectives of the academic program of industrial design establish a direct relationship with the processes of meaning from the cultural identity of the territories (Papanek, 1973). This, therefore, is a sustainable approach to design or from social responsibility, as expressed by Bonsiepe (1978). The definition of social innovation that fits these purposes and the service-learning approach is the one described by Manzini (2013): "Social innovation is a process of change emerging from the creative re-combination of existing assets (from social capital to historical heritage, from traditional craftsmanship to accessible advanced technology" (p. 57)[1], therefore, it is linked to local development in a process of social interaction.

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[1] Innovación social es un proceso que posibilita la combinación de elementos existentes en un territorio, conceptualizando proyectos diseñísticos, producto de las tradiciones y procesos artesanales con los avances actuales de la ciencia y la tecnología.

Method

For the preparation of this case study, qualitative tools with an ethnographic approach were used, such as participatory observation, semi-structured and open interviews, as well as visual records and discourse analysis, in addition to documentary analysis. The questions asked were the following: how does the competence of social innovation contribute to the purposes of innovation and social benefit in a territory, from the industrial design projects described in the graduation profile and the purposes of the educational program? And how can service learning be a tool for the acquisition of social innovation competence? The foregoing through the evaluation of academic projects, the assessment of learning and the acquisition of competencies for the educational program, service actions and the social participation of teachers and students. It was also sought to describe the satisfaction of the needs of a territory as a space for intervention or interaction of the students of the discipline of Industrial Design at the Faculty of Architecture and Design of the UAEM and of the competences for innovation and social bonding.

This work has therefore sought to highlight the use of social innovation competence to satisfy the needs of a community through industrial design projects prepared by students. The case study has been selected following the following steps:

1. Selection of the learning unit (UA) with the greatest potential for the analysis of the variables, contrasting the objectives of the curriculum and the guidelines for social bonding described in the PND and the PRDI, with the purpose of studying the units learning and the potential use of innovation approaches, especially social and service learning.

2. Identification of three groups in the analyzed school period[2]; Semi-structured interviews were used with all the teachers in each group and with the leader of each of the 13 projects analyzed (out of a total of 18 projects of the semester), selected under the criterion of having all the data determined by the program of the UA, representing 72% of them. The foregoing to enable the analysis of the categories of the territory addressed, the project competences, the methodology used in the projects, the fulfillment of the learning objectives, the innovation competence and the service provided to society.

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[2] Periodo del semestre 2019A, que comprende febrero a julio de 2019.

3. Analyze the degree of contribution to social welfare, that is, that it is pertinent and viable, and that it is not only of advertising impact for the institution, because —as stated by De la Torre (2020) - "sometimes leads to precisely privileging the projects with the greatest media impact and not exactly the most strategic for regional development "(p. 11). Observation guides and open interviews with students were used in a series of presentations of academic projects to evaluate the learning acquired and the social satisfaction sought and achieved through community service.

4. Through the observation of the presentations, the methodological approach of the design, the fulfillment of the purposes of the UA and the acquisition of competences, both conceptual and innovation (especially social), were analyzed through discursive analysis of the projects and the satisfaction of the requirements of the social actors described in the project files.

Results

As a consequence of the documentary analysis of the objectives of the industrial design study plan, the project area was selected, which stands out for its intention to link to society in an innovative and efficient way, as described in the proposals of the PND and the PRDI. Table 1 describes the purposes of the ten learning units that make up this area, and from the potential to develop service learning, the descriptions of the innovation and bonding or social responsibility competencies are inferred.

Tabla 1. Análisis de potencial para la adquisición de competencias de innovación

Objetivo del área proyectual o de diseño industrial: "Elaborar propuestas de diseño de forma innovadora y eficiente de acuerdo con los diferentes sectores productivos nacionales, evaluando los entornos sociocultural, estético, natural, humano, productivo, tecnológico y económico de una situación, a través del proceso conceptual, metodológico y de representación, que integre los conocimientos y habilidades adquiridas" (UAEM, 2015, p. 180)				
Nivel	Unidad de aprendizaje	Propósito	Competencia innovación	Competencia de responsabilidad o vinculación social
1.°	Bases para el diseño	"Aplicar principios para la construcción de la forma empleando un lenguaje bidimensional y tridimensional para la conceptualización de objetos diseñísticos" (UAEM, 2015, p. 180).	Capacidad para innovar en la aplicación de los fundamentos para la configuración de objetos de diseño.	Ninguna
2.°	Diseño de objetos simples	"Diseñar objetos simples a través de la aplicación de principios para la construcción de la forma" (UAEM, 2015, p. 180).	Capacidad para innovar en la elaboración de conceptos para el diseño de objetos simples.	Capacidad de evaluar los entornos tecnológicos.
3.°	Diseño de objetos complejos	"Diseñar objetos de baja complejidad a través de la construcción de la forma y función y con énfasis en el uso de los materiales" (UAEM, 2015, p. 180).	Capacidad para innovar en la aplicación tecnológica en el diseño de objetos complejos.	Capacidad de evaluar los entornos tecnológicos.
4.°	Diseño de productos	"Diseñar objetos complejos que empleen mecanismos y donde se identifican materiales y procesos de producción" (UAEM, 2015, p. 180).	Capacidad para innovar en la producción de objetos.	Capacidad de evaluar los entornos productivos tecnológicos y económicos.
5.°	Diseño de productos especializados	"Diseñar objetos especializado con el uso de cualquier mecanismo (…), énfasis en sistema, humano, objeto y	Capacidad para innovar en la relación ergonómica del diseño de productos especializados.	Capacidad de evaluar los entornos productivos tecnológicos, ergonómicos y económicos.

		entorno" (UAEM, 2015, p. 181).		
6.°	Diseño de familia de productos	"Diseñar familias de productos (…) que atiendan a una población con énfasis en los factores socioeconómicos" (UAEM, 2015, p. 180).	Capacidad para innovar en los aspectos socioeconómicos y de interrelación en el diseño de una familia de productos.	Capacidad de evaluar los entornos productivos tecnológicos, ergonómicos y socioeconómicos.
7.°	Diseño de productos sistémicos	"Diseñar objetos sistémicos (…) que atiendan a una población específica con énfasis en los factores estéticos y semióticos" (UAEM, 2015, p. 181).	Capacidad para innovar a través de los aspectos estético-semióticos en el diseño de productos sistémicos.	Capacidad de evaluar los entornos productivos tecnológicos, ergonómicos, estéticos y semióticos, así como socioeconómicos.
8.°	Proyectos de diseño industrial	"Desarrollar un proyecto participativo de diseño en acuerdo con las condiciones socioculturales de un contexto específico, en colaboración con un grupo social o sector productivo" (UAEM, 2015, p. 181).	Capacidad para innovar a través de los aspectos socioculturales en el diseño de proyectos de diseño industrial.	Capacidad de evaluar los entornos productivos tecnológicos, ergonómicos, estéticos y semióticos, así como socioculturales y económicos.
9.°	Proyecto integral de diseño industrial I	"Desarrollar un proyecto de Diseño Industrial de acuerdo con las condiciones socioculturales de un contexto" (UAEM, 2015, p. 181).	Capacidad de innovación en los procesos de investigación para el desarrollo de proyectos de diseño industrial.	Capacidad de investigar los entornos productivos tecnológicos, ergonómicos, estéticos y semióticos, así como socioculturales y económicos.
10.°	Proyecto integral de diseño industrial II	"Evaluar el desarrollo e implantación del proyecto" (UAEM, 2015, p. 181).	Capacidad de innovación en los procesos de evaluación de proyectos.	Capacidad de evaluar la aplicación en los entornos productivos tecnológicos, ergonómicos, estéticos y semióticos, así como socioculturales y económicos.

Fuente: Elaboración propia

According to the result established for these capacities or competencies for innovation, it is inferred that it is in the eighth level or semester - whose learning purpose highlights the contribution of design to the satisfaction of a social need in a given context, together with the possibilities for social responsibility— where they are identified as the ability to assess socio-cultural, productive and economic environments. The UA Industrial Design Projects are considered with greater viability to analyze their academic products and study the possibilities of service learning for the acquisition of the competences of innovation and social responsibility, which enables meaningful learning from interaction with the community.

Table 2 describes the types of territory addressed, the competencies that were used to conceptualize the project, the methodology used for its development, the relevance to the purpose of the UA, the innovation competence developed and the scope of service learning. developed. This as a result of open interviews, which were carried out with UA learning teachers. In this sense, three groups of three teachers each were formed, in addition to the semi-structured interviews of thirteen leaders of student teams from each of the projects analyzed.

Tabla 2. Categorías de análisis

Categoría	Descripción	Resultado del análisis
Territorio	Tipo de territorio abordado y actores involucrados.	Comunidades urbanas y rurales actores sociales integrantes de la comunidad
Competencias	Tipos de competencias empleadas para la conceptualización del proyecto de diseño industrial.	Competencias metodológicas de intervención y de interacción social
Metodología	Tipo de metodología o enfoque del diseño y alternativas para la innovación y beneficio de la sociedad.	Innovación social Ecodiseño Diseño participativo Diseño universal Diseño estratégico
Pertinencia de los objetivos de la UA	Tipo de aportación proyectual del diseño industrial de acuerdo con el objetivo planteado en la UA.	Productos de diseñó industrial Productos de diseño gráfico Servicios de negocios y publicidad
Competencia de innovación	Aportación de productos nuevos a la sociedad.	Innovación económica Innovación social
Servicio a la sociedad	Tipo y alcance de la aportación del proyecto para el beneficio de la comunidad abordada.	Factibilidad social Viabilidad social

Fuente: Elaboración propia

From the above, the diversity of territories addressed, the possibilities for social actions, the various methodological contributions to establish social bonding, in addition to the heterogeneity of products and design discourses, as well as the innovation approach that students conceive and the relationship of service to society that teachers define as feasibility and viability of the projects.

In table 3, from the observation guides of the project discourse of the 13 projects presented and from the interviews with the students, the type and potential of the product designed as satisfying the social need is identified, as well as the type of innovation and connection with society, with the purpose of establishing relationships between service-learning and the acquisition of social innovation and conceptualization skills, which make up the design competence, the axis of the discipline of industrial design.

Tabla 3. Competencia de innovación social

PROYECTO	Territorio y actores sociales	Tipo de innovación	Producto diseñístico derivado del aprendizaje servicio	Detección de la necesidad
1. Centro ecológico para residuos	Interacción con una comunidad urbana a través de funcionarios públicos como actores institucionales.	Innovación socioeconómica.	Sistema de servicios de recolección de basura.	Desperdicio de residuos sólidos en áreas públicas y privadas urbanas.
2. Juguetes multifuncionales	Intervención en una institución hospitalaria en contexto urbano. Personal médico y niños como actores sociales usuarios.	Innovación cultural.	Sistema digital.	Deficiencia en las condiciones de los espacios infantiles.
3. Manual de iconografía	Interacción con una comunidad rural de la etnia mazahua. Actores de la sociedad en general.	Innovación social.	Producto editorial.	Falta de apreciación de la cultura
4. Generador de agua	Interacción con una comunidad urbana de alta vulnerabilidad de San Mateo Otzacatipan. Familia como actores sociales usuarios.	Innovación social.	Sistema de objetos para generar agua potable.	Deficiencia en el abastecimiento de agua.

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5. Sistema para la elaboración de fertilizante	Interacción con una comunidad rural y urbana de Capulhuac. Grupo de actores sociales definidos como barbacoyeros usuarios.	Innovación social.	Sistema de objetos para disminuir la contaminación y aprovechar residuos orgánicos.	Contaminación del río Lerma por residuos orgánicos y falta de aprovechamiento de estos residuos orgánicos
6. Sistema para el aprovechamiento de residuos	Interacción con la comunidad urbana universitaria. Comunidad universitaria como actores sociales usuarios.	Innovación social.	Sistema de servicios para recolección y uso de residuos sólidos.	Falta de aprovechamiento de residuos sólidos con posibilidad de rehúso y reciclaje en los campus universitarios de Toluca.
7. Sistema para sensibilizar en contra de la violencia intrafamiliar	Intervención en la comunidad urbana en Toluca. Grupo social de alta vulnerabilidad de violencia intrafamiliar.	Innovación cultural.	Sistema gráfico para sensibilizar en perspectiva de género y contra la violencia y servicios escenografía.	Alta presencia de violencia intrafamiliar.
8. Sistema de recolección de desechos urbanos	Interacción con representantes de colonias populares de la Cd de Toluca. Grupos sociales urbanos como usuarios.	Innovación sustentable.	Sistema de objetos para el proceso de recolección y desechos urbanos.	Abundancia de desechos orgánicos en vía pública.
9. Sistema para ciclistas en la ciudad	Interacción con un contexto urbano en Toluca. Comunidad	Innovación social.	Manual y productos gráficos para la seguridad.	Falta de seguridad y educación vial en y para ciclistas

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	ciclista y actores sociales habitantes de la ciudad.			
10. Sistema de transporte	Interacción en el contexto urbano en Toluca. Comunidad estudiantil como usuarios.	Innovación social.	Sistema de objetos y espacios para estación de transporte para estudiantes universitarios.	Deficiencias en el sistema de transporte universitario de la ciudad.
11. Sistema de comunicación y movilidad	Interacción en un contexto urbano y comunidad de invidentes como actores sociales vulnerables.	Innovación social.	*App* producto digital.	Deficiencias en la movilidad y comunicación de niños invidentes.
12. Sistema para la alimentación infantil	Intervención en contexto urbano en Metepec. Comunidad preescolar y madres y padres de familia.	Innovación económica y cultural.	Sistema de servicios gráficos.	Falta nutricional infantil en raciones escolares.
13. Sistema de prevención de obesidad infantil	Intervención en el contexto urbano en Toluca. Comunidad escolar en primaria, así como madres y padres de familia.	Innovación económica.	Servicios de venta y comercio justo con punto de venta.	Venta de productos inadecuados para la nutrición infantil.

Fuente: Elaboración propia

The table above highlights the diversity of the objects and systems designed, as well as the sociocultural, economic and productive scopes, as well as the types of innovation developed, which shows a relationship with interaction or social intervention. From the observation guides, the interviews and the speeches made by the students, a relationship is appreciated between the resolution of the social need and the detection of the need, which

highlights the learning acquired through the resolution of the problem in all cases, as well as of the satisfaction of the students when addressing social problems, of a real nature, in the field studies carried out. From the interviews with the students, the type of action they took with the social actors was also known, which resulted in an interaction of the following projects:

- Manual of iconography.
- Water generator.
- System for the production of fertilizer.
- System for the use of waste.
- System for cyclists in the city.
- Transport system.
- Communication and mobility system.

As a result of this interaction, social innovation products were obtained, not so in those projects that used intervention or non-direct interaction with the actors, primary users, resulting in various types of economic, cultural and sustainable innovation.

Discussion

From the analysis of the purposes of the study plan contained in table 1, potentialities were extracted to develop service learning with the purpose of acquiring the competence of social innovation, since the capacities of students to interact professionally in a sector are described of the society. In this sense, the eighth period was chosen for this case study due to its characteristics of social bonding.

Likewise, as a result of the categories analyzed in table 2, it can be indicated that the type of approach to the territory and the actors with whom the students interact, whether they are inhabitants of the locality or government institutions, are conditioning factors of intervention or of social interaction. Likewise, it was determined that in all the projects, learning was developed through service to society, characterized by the type of intervention or interaction action and the type of social actors. No difference was found in this learning by the type of territory approached, since social innovation results were obtained in rural and urban communities.

As a result of the analysis of the competences used for the conceptualization of the projects, it is determined that it is decisive for the achievement of the competence of social

innovation and for learning through service to employ a design approach that privileges social interaction and empathy. to detect the needs of the community, enabling a feedback process. In this sense, the projects that achieved learning through service to society also developed the competence of social innovation that includes interaction with the actors.

Likewise, in the 13 projects analyzed in table 3, it is highlighted that the methodological approaches allowed to implement the undergraduate curriculum, although not all of them allowed to achieve learning and the acquisition of social innovation competence through community service, since the differentiated methodological approach of social interaction or intervention is conditioning.

Regarding the fulfillment of the purpose of the UA, which implied the development of projects that resulted in the conceptualization of three-dimensional objects and services that facilitate their implementation -in accordance with the study plan-, it was identified that the use of service learning and the acquisition of the social innovation competence did not guarantee the fulfillment of said purpose. Therefore, it is inferred from the student interviews that the determining factor was teaching instruction. Likewise, it was observed that the project competence of industrial design was only acquired in three of the projects, and partially in two. In another six competencies from another area of design (graphic design) were developed.

It should be noted that the results obtained from this analysis allowed us to reflect on the construction of social innovation competencies and the elaboration of industrial design projects through service learning as a didactic methodology. This has been addressed by various researchers (eg, Traver-Martí, Moliner and Sales, 2019), who have highlighted valuable results both in learning and in products for the community, although they have not highlighted the acquisition of skills for its development.

In the same vein, the contributions of the Center for the Promotion of Learning and Solidarity Service in Euskadi (Fundazioa Zerbikas, 2014) are identified, which has various projects and initiatives that use this methodological proposal, which are related to innovation to meet specific needs of sectors vulnerable in their region, although without deepening the process of building competencies (Batlle, 2017).

Therefore, it is considered that the results of this study allow us to glimpse a field of opportunity to develop proposals for the construction of learning and acquisition of competences in academic projects of higher education in the area of industrial design through the linking of the curriculum with the territory.

Conclusions

Based on the results obtained in this work, it can be concluded that the social innovation competence must start from the interaction with social actors to establish proposals that are viable and feasible in the territory and promote its development and well-being. Similarly, it is concluded that the degree of social interaction is a conditioning variable of the service learning process with a community.

Regarding the satisfaction of the service to society, its achievement is related to the design approach or method to interact with the community and the ability to detect social need, which, as has already been commented, is decisive for the construction of the competence of social innovation, although it does not guarantee the fulfillment of the purpose of the learning unit.

With regard to innovation competence, proposed as the purpose of the industrial design area that conditions the scope of academic projects, it is determined that the use of service learning does enable the acquisition of innovation competence in any of its areas, and can be of a social, economic or cultural nature.

As a final conclusion, it can be affirmed that by adequately developing service learning using social interaction to detect needs and establish new proposals and concepts based on the culture of the community, the acquisition of social innovation competence is guaranteed. In fact, for the objectives of the learning unit it is possible to develop viable and feasible academic industrial design projects that contribute to local, regional or national development.

Finally, some of the limitations detected in this study have to do with the time spent (one school semester), as well as with the subjectivity of the students' descriptions regarding the satisfaction of social needs. This caused some inconsistencies regarding the scope of social interaction or intervention actions with social actors, direct users of the products developed.

Future lines of research

As future lines of work, it is considered relevant to deepen the analysis of the social interaction capacities of students, teachers and researchers of industrial design to enhance service learning. For this, the competence of social innovation can be used in projects that serve vulnerable communities. In the same way, it is expected to deepen both the opinions of the social actors and the direct users of the design projects and define with greater precision the scope of the service to society.

Likewise, the development of instruments is proposed that allow analyzing the perception of teachers and researchers regarding this service-learning proposal, given their participation in the training process of competencies and interference in the formation of the undergraduate curriculum.

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