# Chapter 11
# Transiting between Representation Technologies and Teaching/Learning Descriptive Geometry:
## Reflections in an Architectural Context

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## ABSTRACT

*Teaching descriptive geometry, in the context of this study, is characterized by the continuous investment in recognizing digital representation technologies which can enhance the didactic activities in architectural training. This study describes this trajectory which includes the use of virtual reality, augmented reality and parametric modelling, as well as freehand drawing and the production of physical models both by automating the unfolding process and by digital fabrication processes of 3D printing and laser cutting. In addition to questioning the relevance and sustainability of the infrastructure needed to ensure the continuation of this trajectory, the potentialities identified in each of the learning activities that have been structure, are shown. Although these potentialities are specific to this context, it is considered that this type of record contributes to understand the issues being faced in teaching practices.*

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## INTRODUCTION

The history of teaching descriptive geometry certainly differs very little in different contexts of architectural training. Aiming specifically at developing spatial reasoning and skills to control and represent geometric form, this history was initially established with, perhaps, differences in the study strategy, whether or not it was applied directly to the architectural form. The bibliographic references of this geometry present the fundamental concepts of representation of point, line and plane. The teachers, geometers with different professional backgrounds, declared insistently the comprehension of the projections of these geometric entities as a solution to any kind of problem regarding the representation of form in two or three dimensional space. This discipline is taught in the beginning of the architectural training and throughout its history registers a strong investment in the development of didactic strategies to accelerate the abstraction abilities required by the intrinsic characteristics of the knowledge in question. The students come from different backgrounds and were often not stimulated to develop such abilities. In Brazil, this problem is registered specially in the GRAPHICA forums promoted by the Brazilian Association of Graphic Expression (ABEG), initially founded as Brazilian Association of Teachers of Descriptive Geometry and Technical Drawing. The reoccurrence of this problem, intensified even after the possibilities offered by graphics computing, is attributed to the changes in the structure of basic education on a national level. Kopke (1996) observed that since the Law of National Education Basis and Guidelines (LDB) from 1971, law n° 5.692, drawing started being addressed in the discipline of Artistic Education and lost its importance. Freshmen students, because of this lack of previous training in abstract geometric thinking, find it hard to understand.

In the context of this study, teaching descriptive geometry in the course of Architecture and Urban Design in the Federal University of Pelotas (UFPel), Brazil, the scenery reflects exactly the situation described above. Until 2011 the disciplines that taught descriptive geometry were offered by the Department of Technical Drawing and Computational Graphics. Professors with different backgrounds such as architecture, art and engineering were responsible for all the representation disciplines offered to all the courses that needed them in the university. Due to the tradition of the department itself, the content taught in these disciplines did not give priority to applying it to the professional context. However, in some moments when the background of the professor was the same as the course for which the discipline was being taught, some initiatives of applying directly to the professional context were registered.

The disciplines offered to Architecture students were called Descriptive Geometry III and IV, and they dealt with graphic-projective procedures aimed at the representation of polyhedral and curved surfaces respectively. Studies of two dimensional geometry were not included being offered only for the undergraduates in Arts. This is made worst by the guidelines for Brazilian basic education because the architecture students were studying spacial geometry without having the basis of 2D geometry. In Descriptive Geometry III these skills were developed from the methods of orthogonal projection with a single plane and from Monge projection and in Descriptive Geometry IV from Monge projection. In both, until 2010 the didactic activities were mainly based on drawing with traditional drawing instruments. Thus, exploring form was limited, considering the time it took to build the representation of a surface on a single point of view, especially when it involved more complex surfaces.

Since 2010 these disciplines started including activities developed through digital graphic representation. In this way, taking advantage of automated methods of projection, accelerating form exploring and transforming in a dynamic and precise way. Furthermore, the disciplines advanced in the use of