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# TRANSFORMACHINES: TRANSFORMING CITY DATA TO ARCHITECTURAL DESIGN STRATEGIES

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An innovative version of the *New Fields of Design and Construction* (NFDC) design methodology course was set in motion at the Postgraduate Program of the National Technical University of Athens (NTUA) last spring. The intention was to experiment with the existing design education framework of learning by doing in an extended learning environment of multiple mediums organized as a representation of the multiplicity of the design praxis. It also aimed at raising student engagement and making students complicit to the formation of the course content.

This process has led to the systematic transformation of the content into both verbal and visual learning units. The course layout was also rearticulated to secure that student performance could be accounted for with a certain precision without shrinking its vast content or limiting knowledge exchange in order to control it.

The student learning outcomes were examined upon the course's completion to verify whether and how e-learning practices can be integrated into architectural curricula. Student attendance rates were closely monitored to register their engagement. The results show increase in course content, high assimilation and continuous interaction between parties. They also show a plurality of approaches toward design, due to the diverse types of students inscribed in the course.

## Introduction

The NFDC course engages in mapping the urban phenomena. It then uses the data retrieved by this research to shape integral strategies of urban interventions. It is designed as a process of making visual and conceptual connections of mapping data, social needs and spatial organizations and not just implementing a single design gesture.

This process depicts the essence of the architectural pedagogy of learning by doing where, "the designer constructs the design world by setting the dimensions of a problem space and then inventing the moves by which he/she attempts to find solutions". (Schon, 1987; p.11) Students of this course are given random stimuli. They are then asked to decipher this data by recognizing patterns and contextualizing them into their respective environments. Thus knowledge comes in the form of creating visual and conceptual mechanisms, *transmachines*

that can turn random information to logical threads by critically joining elements to form reconstructions of the real.

This course arises from the assumption that there can be only subjective interpretations of reality and within this lays the *learning by doing* architectural educational environment. In this framework, the plurality of student backgrounds has been considered an enormous advantage. Students have been repeatedly encouraged to contribute in any way they think is more appropriate according to their understanding of the environment.

The challenge has been to integrate online components to the course to enrich its content and extend its duration outside the temporal limits of the classroom. It was also intended that students were included in the process of content formation by offering their insights and sharing their references with the rest of the class. In this sense, the term *blended*, applies here to both the use of multiple mediums of exchanging content and in sharing responsibility for determining what the actual content would be with the students.

The course redesign improvised new forms of communication by using online networks and thus facilitating the content exchange between all participants. Additionally, it provided the students with knowledge which comes from the multiple ways of transforming data. This system of producing knowledge out of random ways of interpreting the urban environment fits the very objective of this course; understanding and managing the complexity of the city. There is a cyclical act both in learning and reconfiguring the realities of the city as students realize that any result cannot be reduced to a single definitive form; rather, it emerges as a dynamic calibration of the unlimited complexities of the built environment and how these can be met in the urban field.

This paper examines the process of the course redesign and assesses the outcomes of its implementation. The course deals with the urban scale, a specific area of transition between Egaleo and Elaionas, its interpretation and understanding through the use of a variety of approaches. It starts by illustrating the nature of the content material, the mapping tools and their inherent relation to the aims of the course through illustrative examples. Then it follows the course's dual layout in the online and in class environments and the different networks of communication it established. It continues by describing the process of creating countable structural elements to serve the particularities of each learning environment. These elements will constitute a commonly shared verbal and visual language between the students and the teaching team. It consecutively presents student learning outcomes and assesses their performance in the framework of the blended reconstruction of the course. In the final section, the authors will conclude by highlighting the benefits that this specific e learning environment offers to the students.


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## Course Content: Selecting the mapping tools by means of their capacity to represent contemporary urban realities

The course content material consists of a set of mapping tools that examine the extremely complex urban realm in distinct visual and verbal representations. A series of examples of these tools' applications were also employed to illustrate their potential in configuring city fabric.

The tools for urban mapping were selected among the most recent PhD dissertations and Design Research that is currently conducted in NTUA Architectural Postgraduate Programs. They established the main body of the course content focusing on measuring and categorizing the urban phenomena with the ulterior aim to manage their complexity. They stem from both analytical and experiential origins. Their specific manner of reading the city becomes itself a method of both intellect and visual organization offering distinct description logic.

The hybrid learning environment that was fabricated required the integration of the course content in an online platform. The presentations of the mapping tools were disseminated online over a period of ten weeks. During this time, all content units related to each one of them were consecutively uploaded; each week, a new tool would be added to the already existing content corpus. The order of their appearance was random and depended mostly on a balanced collocation based on their level of difficulty.

The lack of a linear, progressive succession of content was explicit of the course's intention to create an interactive model of cognitive development that recognizes the power of background social knowledge and sensory experience (in this case spatial perception as well) to transform the understanding of the world. (Vygotzky, 1986; pp.12-57) It also matched the inconsistency that is inherent in the city, whose understanding has been this course's main objective. No tool was made to appeal as more important than the others, and none of them functioned as a prerequisite for understanding the rest of them. Furthermore, they could acquire different meanings according to subjective readings and through different interpretations. As Downes states:

> *"Knowledge is literally the set of connections between entities. In humans, this knowledge consists of connections between neurons. In societies, this knowledge consists of connections between humans and their artifacts. What a network knows is not found in the content of its entities, nor in the content of messages sent from one to the other, but rather can only be found through zecognition of patterns emergent in the network of connections and interactions." (Downes, 2012; p.9)*

In designing the course content material, the next important step was to contextualize the data retrieved by each tool and relate them to real life problems. To help students comprehend the tools' inner logic, during the online presentations and the in-class sessions, a series of examples of actual applications of the mapping techniques were analyzed in depth. These examples illustrated the tools' potential and inclusiveness and the way they can relate to the


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urban realities. Most of them were study cases included in a major Research Project for the Metropolitan Area of Athens conducted recently by NTUA on behalf of the Regional Administration. The sense of *situatedness*, the interaction between the designer and the environment that determines the course of designing these examples provided enabled a deeper understanding of the tools' methodology (Gero & Kannengiesser, 2002). Linking the students to an urban landscape they were already familiar with allowed for a better perception of core principles. The full report of the Research Project (an online volume of almost 600 pages) was made available to the students as a guide from the beginning of the course to help them navigate the tools' numerous applications.

## Course layout: Transforming learning into e-learning by creating multiple collaborating learning environments for the exchange of content

After establishing the course content that was to be transmitted online, what needed to be determined was its temporal connection to the in class sessions and the creation of the networks within which the content exchange would take place. Previous experience had shown that long presentations in class left little or no time for conversation or further elaboration. There was a growing need to develop a different system of communication between the teaching team and the students that would extend the duration of their interaction.

It was decided from the start that in the online environment students would have to go through each unit before coming to class. This decision addressed the need to ensure that the students familiarized themselves with each unit in time so that the quality of their in class presence would be more substantial. Once accustomed to each tools' main terms and characteristics it would be easier for them to comprehend the tools' inner sense and – why not? – start using them themselves.


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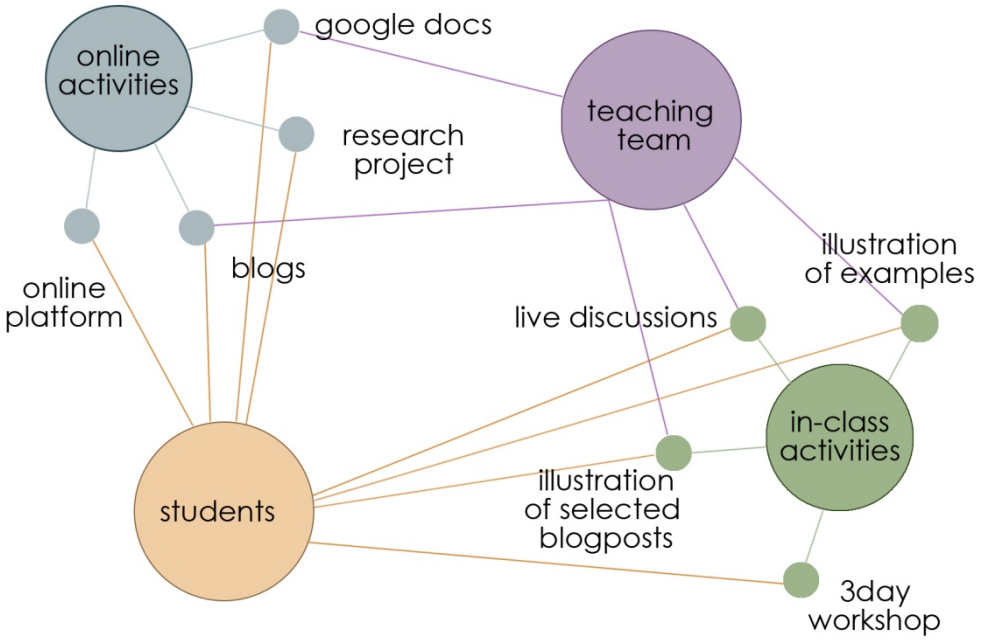


Figure 1. Online and in-class content layout and exchange paths – The figure shows the course's main features and the reciprocal character of the teaching team and the students' communication paths.

The in-class aspect of the course developed during the weekly meetings where all parties were able to exchange views and argue on the content. During this time students were able to address any possible questions raised from their online attendance. The teaching team used the time to contextualize the material transmitted in the week's course and to check on the students' comprehension of each unit by illustrating examples of applied cases. Tutorials' demonstrations of software were also shown to illustrate the synergy of the mapping with digital programs. In addition, some of the most interesting student blog posts were selected each week and discussed further with the students.

The course layout was conceived as an open system of content exchange in multiple intermingling environments (Figure 1). This way, the students could get in touch with the course content in the manner that best suited their learning habits. During the week's time they had to prepare for their in class attendance the students could watch the online content as many times as they wished; browse through the links suggested by each speaker; consult the Google docs established in the course; study the Research Program; download and experiment with relative software and tutorials. In parallel, they could also conduct their own independent research on other mapping techniques; make their findings known to their fellow students through their own blogs; check on what their mates had already uploaded.

One of the main objectives of the course was to create a learning process the students themselves could moderate based on the grade of their involvement. Following Freire's libertarian educational model, teachers and students have been considered partners in the learning process "where they both exchange roles and reflect upon transforming the world"


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(Freire, 1970; p.76). The course setup acclaimed student collaboration and their active engagement and expected the teaching team to always remain alert toward student feedback.

This attempt also agreed with the core principles of the "connectivist" educational practices of massive open online courses, where learning consists of the ability "to construct and traverse networks of connections" (Downes, 2012, p.9). The fact that the course was elective established a sense of synergy from the beginning where both parties entered this venture knowingly that they would be sharing responsibility for its actual development. That was one major shift in rethinking the traditional format; making everyone accomplice to the process (Figure 2).

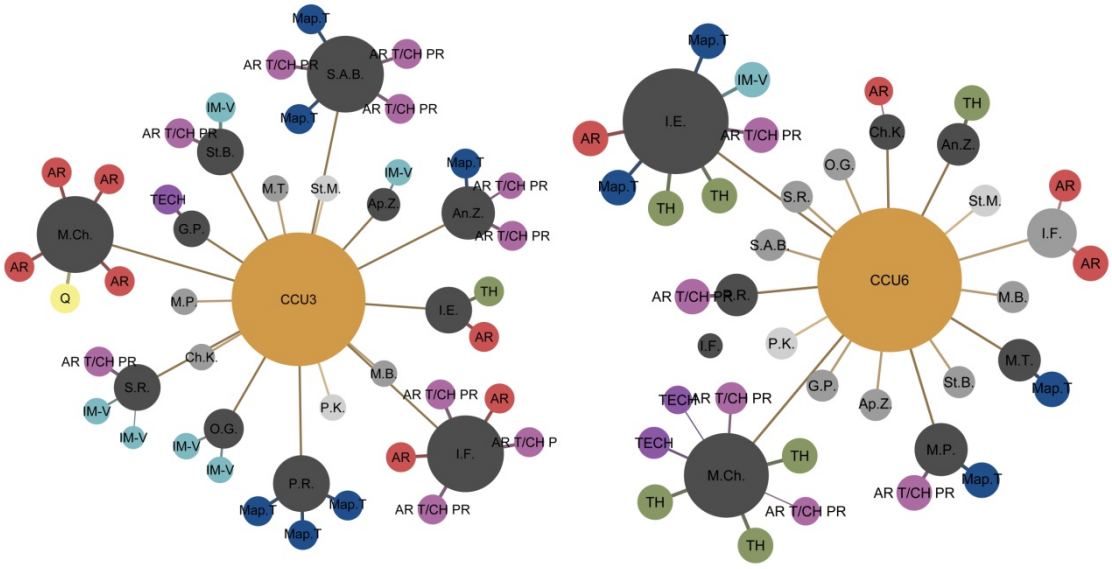


Figure 2. Student blog post activity in regard to course content for weeks 6 and 9 of the course – Yellow circles represent course content transmitted at that time; grey circles represent; their size variation regards the number of posts published during that week. The rest of the coloured circles around each student represent the various types of blog posts he/she published in regard to content. (Articles in red, essays in green, mapping tools in blue, images and videos in cyan, artistic of architectural projects in magenta, technology related posts in purple)

At the end of the semester the students participated in a three day design workshop where they were asked to use the course content tools discussed in class and online; or form their personal interpretation of the tools; or use the tools as inspiration to establish their own, to map the area between Egaleo and Elaionas situated at the core of the Athenian metropolis. The area that was indicated to students presented an interesting discontinuity of the urban tissue, a fact they were called upon to analyze and assess. The aim was to make students work with whatever tool caught their attention, combine tools, or even come up with a new one more suited to investigate the area under examination.


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## Course articulation: Transforming learning into e-learning by creating countable verbal and visual structural units

The material that was to be transmitted as online content underwent a series of transformations in order to conform to its new medium. The original three hour long in class presentations were narrowed down to forty minute online lectures that were further dismantled in maximum seven minute videos. Additional material was also inserted in the form of images, diagrams, online articles, software, tutorials and references to related bibliography for whoever cared to scratch the surface. This process of condensation limited the course duration but it also interfered with the course core components; its visual and discursive expression respectively.

As for the course's verbal vocabulary, a series of terms defining each tool was introduced and systematically used to describe the design approach suggested by each one of them. Clusters of words in the form of terminology especially configured to verbally represent the inner structure of description logic were now promoted to key structural units of the course.

A lexicon was set up to include those terms in an open to all Google document that run parallel to the course and served as a hybrid dictionary. The students could consult it to look up the meanings of the terms used in the course. They were also given the freedom to alter whatever felt unsuited or irrelevant. All definitions were treated as suggestive and therefore incomplete and open to translation. As the course advanced students were actually encouraged to modify them, add more to them, or even drastically transform them to fit in with some missing element of meaning relative to their line of thinking. Thus the course content was open to interpretations; alterations; highlighting its openness and its resistance towards entrenched perceptions.

Apart from the organization of the course verbal elements there was the need to also transform at least a part of the visual representations of the course into distinct structural units as well. As was mentioned earlier, the course was particularly oriented toward the formation of spatial design and the constitution of the argumentation that supports it. So in the course's overall development, the visual language drew more from schemata of thought enriched by additional sensual or digital spatial data. The visual medium parallel to the verbal "offers structural equivalents to all characteristics of objects, events, relations i.e. readily definable patterns, of which the geometrical shapes are the most tangible illustration" (Marda, 1996; p.257). The purpose has been to depict urban reality by featuring selected urban entities and their interrelations in open schemes. These would be susceptible to change and interpretation by whatever means were necessary and available to the student/designer. These representational schemes became the visual structural units of the course, for they were able to capture meaning in purely design expressions.

In addition, as some of the tools presented in the course make use of particular software, the physical expressions of their argumentation are often founded on the diagrammatic structures these programs produce. These representations result from simple or more elaborate


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algorithmic coding and often create their own complex graphic ontology that addresses the particular entities they try to decipher. They too, assisted the communication of meaning and they were intensively adopted by the students.

## Course earning Outcomes & their Assessment: Transforming data into knowledge by examining the incorporation of the structural content units in student projects

The dual presence of the course both online and in-class creating multiple layers of communication and the hammering of its content to countable structural units of meaning, verbal and visual, allowed the teaching team to assess almost every aspect of the students' performance.

Instead of seeking a uniform audience, the course made the most out of student diversity, using their individual profiles to shape different description logic and expressions. Despite the necessity to control the learning outcomes this course did not ask students a given product; instead, it encouraged them to shape their own subjective threads of thought by linking data and interconnecting their representations accordingly. Their projects represent a multiplicity of design approaches and reveal the subjectivity of their argumentation.

The online platform allowed a close monitoring of student attendance as "increases in the amount and kind of educational data offer researchers new opportunities to observe, analyze, and ultimately improve the learning process" (DeBoer et al., 2014). The data gathered throughout the duration of the course offer a precise insight of the number of their weekly visits and their overall on line attendance habits.

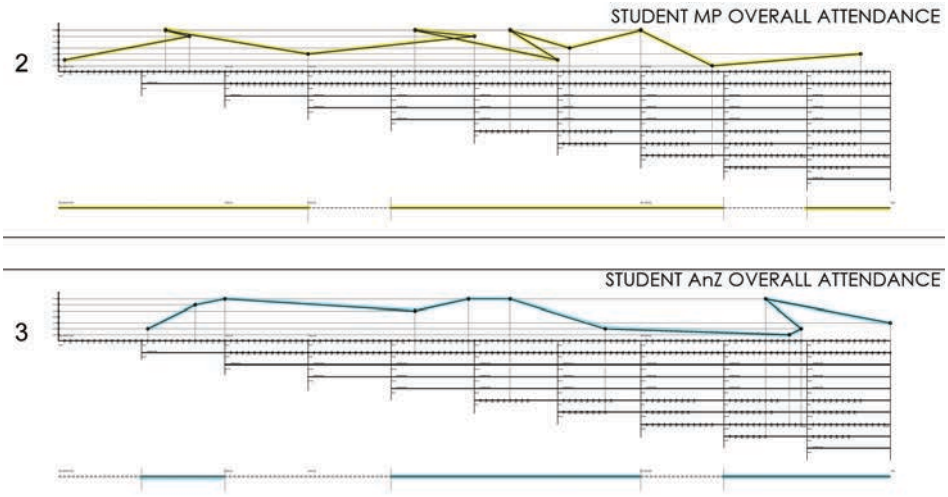


Figure 3. Student online attendance charts –The coloured lines show the diversity in the overall student online attendance habits and preferences. The crooked lines represent their learning paths, while the straight lines in the bottom represent their weekly visits.

Most importantly, through the use of the online platform, students were given the chance to follow the course at their own pace and deepen their understanding of whatever seemed more intriguing to them. The students' registered online movements are shown in their individual


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attendance diagrams. As seen even in this limited sample of a total of seventeen students no two look alike. Attendance charts vividly illustrate the students' individual preferences towards some course units and their repeated visits to videos they watched for several times (Figure 3).

One of the most interesting aspects of the course layout, however, lay in the online student content transmissions through their own blogs. Their posts were accounted for and further analyzed in regard to the course content. An overall amount of a hundred and forty six blog posts uploaded in ten weeks' time included the presentation of at least twenty additional mapping tools; almost forty articles on assessing mapping data; a vast documentation of artistic or architectural projects that embedded major principles of the course content (Figure 4).

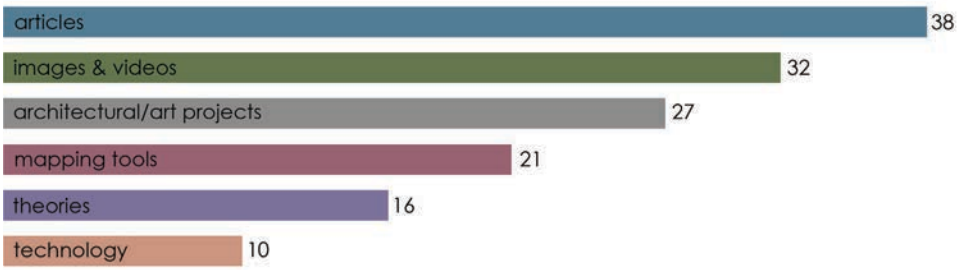


Figure 4. Type and quantity of student blog posts

This additional communication channel has helped the less active students to express themselves and share their views with the others. It also kept the in class discussions running throughout the week until the next meeting as students uploaded more material related to the ongoing arguments. The blogs in particular have proved beneficent in this regard by continuously linking individual student interests with the course content and with the rest of the class. The clouds of interaction vividly illustrate this constant exchange.

The three-day design workshop on the other hand, realized at the end of the semester, determined the sum of the course deliverables and the final project students would be rated upon. Each student was asked to map the given area between Egaleo and Elaionas and deal with its complexity in the scale they desired, eventually bringing to life their completely different perspectives. The students were asked to implement this task by using both visual and verbal tools in the way these were presented throughout the course.


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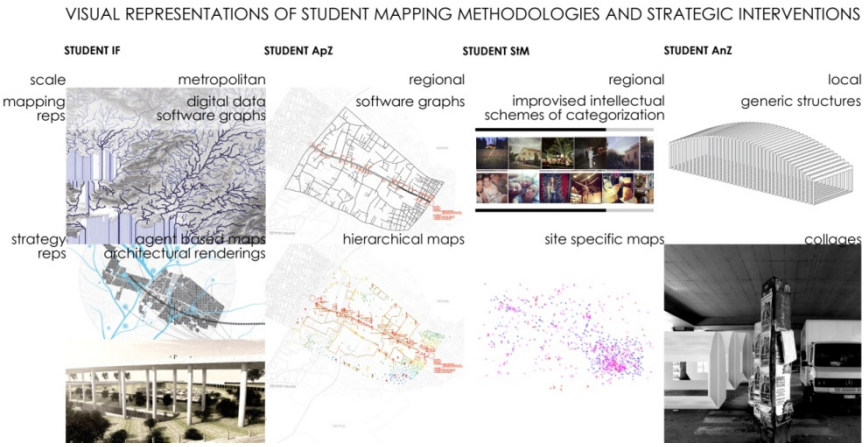


Figure 5. Samples of the students' visual representations during the workshop – One can see the way the implemented their mappings in Egaleo and Elaionas and the varying design and mapping scales they used to approach the subject as well as the representational mode they chose to illustrate their proposals.

All student projects were consecutively evaluated in regard to their affinities in terms of their visual and verbal expressions with the course content. Despite the divergent mapping methodologies that were applied and the different scales of intervention, all student projects were represented mostly through diagrams and graphs or generic architectural forms. The visual expressions of the student projects were immensely influenced by the course content tools' inner sense as well as the software that supports them. All of the students illustrated their findings using intellectual schemes from the given course toolbox, while some of them even invented new mapping tools or new representational models for the mapping data they retrieved (Figure 5).

The other aspect of the evaluation of student learning outcomes dealt with their verbal argumentation of their projects. A thorough analysis of the two page essays they were asked to submit along with their design proposals highlighted the frequent use of the course terminology as this was presented in the Lexicon and introduced by the mapping tools throughout the duration of the course.

Finally, the affinities between student posts and delivered projects were investigated. The clouds of student blog post interaction illustrate their constant exchanges of online content throughout the duration of the course. They also reveal the similarities between student interests and uncover the blog post threads that directly or indirectly influenced students' workshop projects (Figure 6).


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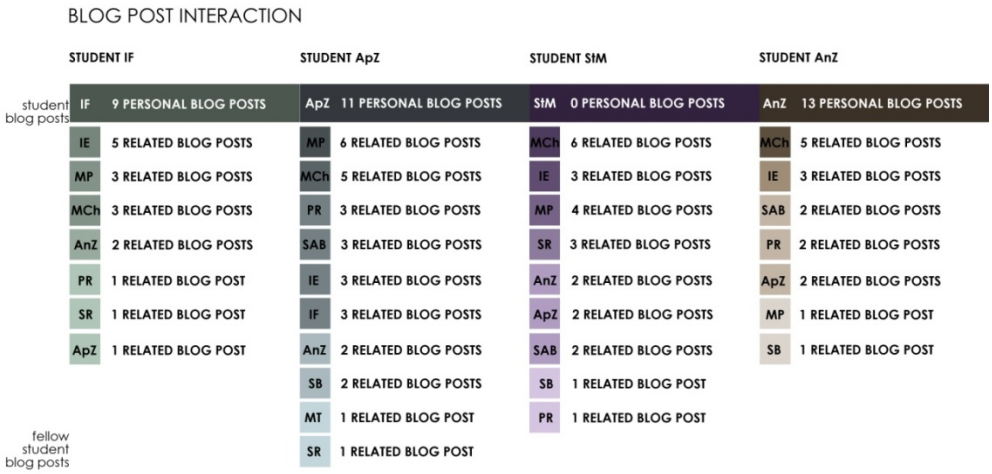


Figure 6. Student blog posts affiliations in regard to their final workshop project

## Conclusion

Despite the theory supported by many that architecture is well off without permanent or accurate boundaries (Baird, 1996), its fluid, dual character, visual and verbal, makes it difficult to set the limits in an educational curriculum. Let alone using open online learning environments to do it where it is impossible to fully control the flow of information. The learning by doing architectural educational model, however, requires the students to form their own interpretations of reality. And the course's online presence could not jeopardize this; instead, it could actually facilitate it by making students active agents in the learning process.

The increase of stimuli and communication channels between the interacting participants was what this course set to create from the beginning. The coordinators provided the basic course content, the learning environment and a system of data exchange formed by countable visual and verbal units. The process included:

- The selection of innovative mapping tools by means of their capacity to represent contemporary urban realities,
- The dependence of the course layout on multiple collaborating learning environments for the exchange of content,
- The creation of the course articulation by determining countable verbal and visual structural content units to disseminate the information to all participants.

A thorough analysis of student engagement as it has been registered through the monitoring of their activities reaffirmed that students do not learn in the same manner. In this regard, the flexibility of this hybrid course that did not direct them towards specific approaches enabled the students to pursue their own learning paths without missing on the content.


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The student learning outcomes demonstrated how the transformation of the course content into visual and verbal units was assimilated into student projects and how the students used the terms and the representations shown to them to argue their own work. It also showed how the e-learning practices that were adopted in this class facilitated the exchange of information and activated student interest. The students were challenged to express themselves in more than one ways and they responded to this task. They contributed to the content through the online environment multiplying the material offered.

Eventually, what this process generated was a course whose content was determined by both parties. The quality of the exchange that took place was in that sense, unique. The course cannot be repeated as such for a second time. The determination of its content will always depend on the participants' individual profiles, their preferences and their level of interaction.

This discovery linked the course formation directly to the complexity of the city itself. Just like the course depended on its participants to obtain its final form, the mapping and managing of the urban phenomena depended on the personal hierarchies of the people involved in realizing them. What was created was a direct metaphor, a mirroring of one process onto the other.

Future plans for the course include the enrichment of the online material with additional tools from other disciplines as well and the inclusion of this year's projects to the content corpus as a reference for the future students. More emphasis will also be given to software tutorials and online data exchange.

## References

1. Baird, G. (1996). Notes on the Fate of the Architectural Profession in the Post-Structuralist Era. In W.S. Saunders (Ed.), *Reflections on Architectural Practices in the Nineties* (pages 65–67). New York: Princeton Architectural Press.
2. DeBoer, J., Ho, A., Stump, G., & Breslow, L. (2014). Changing "course:" reconceptualizing educational variables for massive open online courses. *Educational Researcher, 43*(2), 74-84. doi: 10.3102/0013189X14523038, page
3. Downes, S. (2012). Connectivism and Connected Knowledge: Essays on meaning and learning networks. National Research Council Canada, Version 1.0 – May 19.
4. Freire, P. (1970). *Pedagogy of the Oppressed.* (ed. 2005, trans. Myra Bergman Ramos, pages: 70-76). New York, London: Continuum.
5. Gero, J.S., & Kannengiesser, U. (2002). The situated function-behaviour-structure framework. In J.S. Gero (Ed.), *Artificial Intelligence in Design* (pp. 89-104). Dordrecht: Kluwer Academic Publishers.
6. Marda, N. (1999). *Architectural Concept Formation: Transmission of knowledge in the design studio in relation to teaching methods.* (Doctoral Dissertation), Bartlett School of Graduate Studies, Faculty of the Built Environment, University College London.


ISBN 978-615-5511-10-3

7. Schon, D. (1987). Educating the Reflective Practitioner: Towards a New Design for Teaching in the Professions. San Francisco: Jossey-Bass.
8. Vygotzky, L. S. (1986). *Thought and Language.* Cambridge, London: MIT Press.


ISBN 978-615-5511-10-3