CADERNOS PROARQ 30

MÔNICA MARIA FERNANDES DE LIMA, MAÍSA FERNANDES DUTRA VELOSO E GLEICE AZAMBUJA ELALI

Paper Folding as an aid to visual perception and to the conception of architectural forms

A dobradura de papel no auxílio à percepção visual e à concepção da forma arquitetônica

Mônica Maria Fernandes de Lima

Graduada em Arquitetura e Urbanismo (1985), mestre em Engenharia Mecânica (1990) e doutora em arquitetura e urbanismo (2017) pela Universidade Federal do Rio Grande do Norte. Começou sua carreira acadêmica em 1994 na Universidade Potiguar e em 1996 ingressou na Universidade Federal do Rio Grande do Norte, hoje é professora adjunta do Curso de Arquitetura e Urbanismo. Desenvolve estudos na área de Representação e Linguagem e ministra as disciplinas de Representação Gráfica de 2005 a 2018.

UnderGraduate in Architecture and Urban Planning (1985), Master's degree in Mechanical Engineering (1990) and Ph.D. in Architecture and Urban Planning(2017) by the Federal University of Rio Grande do Norte. She began her academic career in 1994 at the Potiguar University and in 1996 she joined the Federal University of Rio Grande do Norte and is now an adjunct professor of the Architecture and Urban Planning Course. She develops studies in the area of Representation and Language and teaches the disciplines of Graphic Representation from 2005 to 2018.

monicamfl@gmail.com

Maísa Fernandes Dutra Veloso

Possui graduação em Arquitetura pela Universidade Federal de Pernambuco (1985), mestrado em Desenvolvimento Urbano pela Universidade Federal de Pernambuco (1992) e doutorado em Géographie, Aménagement du Territoire et Urbanisme - Université de Paris III (Sorbonne-Nouvelle) (1996). Fez pós-doutorado na École Nationale Supérieure dArchitecture de Marseille (ENSA--Marseille, 2013). Atualmente, é Professora Titular do Departamento de Arquitetura da Universidade Federal do Rio Grande do Norte (UFRN), atuando na graduação e nos Programas de Pós-graduação em Arquitetura e Urbanismo (mestrado acadêmico e doutorado) e em Arquitetura, Projeto e Meio Ambiente (Mestrado Profissional).

Undergraduate in Architecture by the Federal University of Pernambuco (1985), Master's degree in Urban Development by the Federal University of Pernambuco (1992) and Ph.D. in Géographie, Aménagement du Territoire et Urbanisme - Université de Paris III (Sorbonne-Nouvelle) (1996). She did postdoctoral École Nationale Supérieure dArchitecture de Marseille (ENSA-Marseille, 2013). Currently, she is a Professor of the Architecture Department of the Federal University of Rio Grande do Norte (UFRN), working in the undergraduate and postgraduate programs in Architecture and Urban Planning (academic master's and doctorate) and in Architecture, Design, and Environment Professional Master's).

maisaveloso@gmail.com

Gleice Azambuja Elali

Arquiteta e Urbanista (UFRN, 1982), psicóloga (UFRN, 1987), mestre e doutora em Arquitetura e Urbanismo (USP, 1996, 2002). Docente na UFRN desde 1994, atualmente é professora e pesquisadora nas áreas de projeto de arquitetura e psicologia ambiental.

Architect and Urban Planner (UFRN, 1982), psychologist (UFRN, 1987), master's degree and PhD in Architecture and Urban Planner (USP, 1996, 2002). Professor in UFRN since 1994 actually is teacher and researcher in areas of Architectural Project and Environmental Psychology.

gleiceae@gmail.com

Abstract

In contemporary university education, learning must be experienced as the result of a process of continuous construction, in which learning takes place through dynamic search processes and must be acquired in an integrated way. This paper is a cross - section of a doctoral research that presents paper folding techniques as an aid to the development of visual perception and the formal conception of the students in the first year of the architecture and urbanism course. It is understood that the folding techniques are instruments able to collaborate with the apprehension of the knowledge of the geometry and to promote the development of the abilities related to the visualization and conception of the form. Thus, in order to discuss the potential of the fold as a tool that favors the creation process, workshops were held with undergraduate students in Architecture and Urbanism, in which Paper Folding, Surface Development, Origami and Tessellation techniques were applied. This article briefly summarizes the results of the experiments carried out in these workshops in order to demonstrate the importance of the use of paper folding in the teaching / learning process in the initial design disciplines. We verified the potential of the fold as a tool of conception, since it allowed: the exploration of the concept of continuity and complexity; the favoring of the creation process and the optimization of the teaching / learning relationship. These results indicated the potentiality of the use of the paper model and the function of the workshops as experiences capable of favoring the design processes. Besides these factors, it was possible to perceive the presence of mimicry and geometry in the initial moments of conception of the form, through an integration exercise, defined by the methodology. These results supported the recommendations for the teaching of architectural design focused on the initial periods.

Keywords:: Teaching. Project. Folding. Visual Perception. Formal Conception.

Resumo

No ensino universitário contemporâneo, a aprendizagem precisa ser vivenciada como fruto de um processo de construção contínuo, no qual o aprender ocorre por meio de processos dinâmicos de buscas e deve ser adquirido de forma integrada. O presente artigo é um recorte de uma pesquisa de doutorado já concluída, que analisa técnicas de dobradura em papel como instrumento de auxílio ao desenvolvimento da percepção visual e da concepção formal dos alunos no primeiro ano do curso de Arquitetura e Urbanismo. Entende-se que as técnicas de dobraduras são instrumentos capazes de colaborar com a apreensão do conhecimento da geometria e promover o desenvolvimento das habilidades relacionadas à visualização e concepção da forma. Assim, a fim de discutir o potencial da dobra como ferramenta que favorece o processo de criação, oficinas foram realizadas com estudantes de graduação em Arquitetura e Urbanismo, nas quais foram aplicadas técnicas de Paper Folding, Surface Development, Origami e Tessellation. Este artigo apresenta parte dos resultados das experimentações realizadas nessas oficinas. Verifica-se o potencial da dobra como ferramenta de concepção, uma vez que permitiu: a exploração do conceito de continuidade e complexidade; o favorecimento do processo de criação e a otimização da relação ensino/aprendizagem. Os referidos resultados indicaram a potencialidade do uso da maquete de papel e a função das oficinas como experiências capazes de favorecer os processos de concepção. Além destes fatores, foi possível perceber a presença do mimetismo e da geometria nos momentos iniciais de concepção da forma, por meio de um exercício de integração, definido pela metodologia. Estes resultados fundamentaram as recomendações para o ensino de projeto de arquitetura voltado para os períodos iniciais.

Palavras-chave: *Ensino. Projeto. Dobradura. Percepção Visual. Concepção Formal.*

Introduction

The revision of the literature has indicated that students usually present difficulties in understanding the contents of the geometry classes in the first semesters of the Brazilian Architecture and Urbanism undergraduate degree courses. It has also been noticed, in some cases, a limited integration of the contents between the areas of "Representation and Language" and "Architectural project", which impairs the understanding of bidimensionality and tridimensionality by the students. Therefore, conceiving the issues of spatiality is one of the great difficulties faced by Architecture undergraduates in Brazil.

Given this context, we advocate for a revision of the teaching of geometry applied to Architecture, considering that, in the undergraduate courses, it still is mostly practiced in a traditional manner. In this sense, Marcos Pereira Diligenti (2006, p. 12) recommends "a reevaluation and a transformation of the path of conceiving a scientific object usually constructed in this area, as well the deriving pedagogical approaches that are constituted from this parameter of understanding science." Moreover, the author proposes the vitalization of the teaching of geometry by an integrated analysis, pointing out the need of a reflection regarding this aspect, both in terms of the elaboration of the undergraduate course syllabus, and in the definition of pedagogical activities.

By pointing the paths to be taken in the vitalization of the teaching of geometry, José Euzébio Costa Silveira (2008) talked about some issues related to the traditional way of teaching the discipline of descriptive geometry (such as the approach dissociated from architecture and from the professional practice; the discipline being categorized as theoretical; exercises with isolated geometrical shapes; and the bibliography, which is difficult to understand). The author has proposed the following alternatives to this model: the presentation of examples that simulate the practice of architecture; the exploration of the abstract contents through tridimensional models, which can be seen as architectural elements; the proposal of solutions of building covers from the content of intersection of planes; and studies of shadow, using plants and façades.

Students' difficulties in this field are also due to the fact that the ability of spatial reasoning has not been sufficiently developed in elementary and high schools. Although software with resources such as "moving drawings" may be tools capable of promoting solutions for those difficulties in assimilating the geometrical and mathematical properties regarding spatiality, manual and ludic activities cannot be overlooked, because they facilitate learning through malleability, allowing students to perform a content acquisition process starting from the concrete to reach the abstract, while enjoyable and fun practices evoke their interest. Therefore, the application of exercises with mock-ups, using paper folding techniques, may stimulate students' creativity.

According to Rick Beech (1982, p. 10), "paper folding originated in China around the 1st or 2nd century AD and reached Japan in the 6th century[...][1]"and from the 8th century onwards, paper folding began to be used in Shintoist ceremonies, representing deities worshipped by the Japanese. Thaís Regina Ueno (2003) states that, in the 8th century AD, the Moors had already employed paper folding techniques in the teaching of geometry. In 1797, the first written instructions were published in the work "Senbaruzu Orikata" (How to Fold a Thousand Herons). In the beginning, this technique was transmitted from parents to their children and, in 1876, it started being taught in Japanese schools. Ricardo Lourenço (2011, p. 27) says that "in Japan, in the middle of the 19th century, origami began to be applied as a teaching resource in artistic education".

1 From the original : "Paper folding originated in China around the 1st or 2nd century AD, and reached Japan in the 6th century." (BEECH, 1982, p.10).

According to him, "origami applied in education in Japan was greatly influenced by Wilhelm August Fröbel (1782-1852), a German educator who used paper folding to develop geometrical shapes" (2011, p. 27). However, after World War I, origami classes were eliminated from Japanese schools.

Origami has also been employed as a teaching tool at Bauhaus, the German school of architecture and design. As Erik Demaine and Martin Demaine would see it, "the earliest known reference of curved-crease sculpture is from a student's work at the Bauhaus, from a preliminary course in paper study taught by Josef Albers in 1927-1928[2]" (2015, s.p.).

Contemporarily, paper folding techniques are explored in several fields of knowledge and they have contributed to technological advances, as it can be noticed through the relationships between origami, mathematics and science that happen today.

> ***Besides the field of architecture and design, paper folding techniques have contributed to the technological evolution by promoting solutions for problems in space engineering, mechanics and medical sciences. This fact has occurred due to the intersections between origami, mathematics and science discovered by Robert Lang, a north-American physicist and origamist who classified the aforementioned paper folding technique in three categories: mathematical origami, which describes the basic laws of origami; computational origami, algorithms and theories dedicated to problem solution; and technological origami, paper folding for the solution of problems that arise in engineering, industrial design, and technology in general. Since then, paper folding techniques have favored the creativity and originality potential in contemporary projects in the aforementioned fields. (LIMA, 2015, p. 3)***

Considering the questions presented above, as well as our experience in teaching Graphical Geometry 01 and our participation in congresses and events in this field, we understand that this subject can be dealt with in an integrated manner between the contents of the syllabus of the "Representation and Language" and "Architectural Project" areas.

In a doctorate research which is already concluded, it has been verified the potential of geometry and, more specifically, of paper folding techniques as an auxiliary instrument to visual perception and shape conception in the first year of the Architecture and Urbanism undergradute degree course of the Federal University of Rio Grande do Norte, Brazil, where we teach. With the present study, we hope to contribute to the advancement of the area of geometry applied to the project – a determining field in the formation of the architect – from an investigation guided by integration and aimed to enhance the students' knowledge.

Methodological procedures

Based on a bibliographic research on the themes "geometry teaching", "architectonic project teaching", and "paper folding techniques", the empirical research corresponded to a case study which was performed in Architecture and Urban Planning course at Federal University of Rio Grande do Norte (UFRN),and which happened through mini-courses – named "Paper Folding Techniques" – whose aim was to investigate the participants' shape reasoning skills and to present paper folding as a technique

2 From original " The earliest known reference of curved-crease sculpture is from a student's work at the Bauhaus, from a preliminary course in paper study taught by Josef Albers in 1927–1928." (HISTORY…, 2015, s.p.).

(material folding, that is, paper folding) and as a possibility for beginner students to develop shape conception. The twelve-hour activity was divided in sessions and was composed of four workshops (described below), which explored the utilization of the techniques.

- Paper folding – a test that uses folding on a square, perforated paper;
- Surface development – a test based on the imagination and/or visualization of a folding from the planning of an object, created by Harry H. Harman et al. (1976), employed for the development of shape reasoning;
- Origami (and its variations) – Japanese art of paper folding.

At the beginning and at the end of each mini-course, the students answered questionnaires. First (before the workshops), the aim was to investigate whether, when joining the course, the students had practiced any activity that required shape reasoning abilities and influenced the results of the applied exercises. This questionnaire was based on Norma Boakes (2011), having investigated basic demographic information about the student and their involvement in activities linked to the "shape reasoning" skill. In adapting the instrument to the local reality, ethnicity was ignored due to the low incidence of foreign students at the beginning of the studied course, particularly of those originating from Eastern countries, where the practice of origami is more widespread. After the workshops, students answered another questionnaire in order to evaluate the applied tests and to indicate the difficulties they had experienced.

First workshop: paper folding and shape reasoning

Based on the reference tests and in the activities presented by Elizabeth Hernandéz Arredondo (2007), two exercises were performed in the first workshop.

- Exercise 1: starting with square papers, the students folded and perforated them once. Then, they drew the result before unfolding the paper. They were asked to perform three exercises with one, two, and three folds. This type of exercise required concentration in the folding phase and shape reasoning while drawing the result of the perforation, besides notions of two geometric concepts: reflection and symmetry.
- Exercise 2: surface development test was taken as reference, as well as its computerized version. It consisted of the planning of an object, but, instead of numbers, colors – which should be identified in the perspective – were used in the edges. From the alternatives presented, the student had to choose which ones correctly informed the position of the edges marked in the planning.

Second workshop: origami

To introduce the basic notions of origami, two exercises were performed, in order to familiarize students with diagram reading.

The first exercise was about building a triangular surface, created with square paper to produce a tetrahedron, a pyramid, and their connecting pieces.

The second exercise was about building the connecting pieces necessary for the construction of the tetrahedron and the square-based pyramid.

Third workshop: Tessellation

Since the patterns employed in the paper folding projects are essentially defined through symmetries, four basic types of bidimensional symmetry were used in this workshop: translation, reflection, rotation and reflection sliding.

Fourth workshop: architectonic element

In the fourth workshop, students used paper folding techniques to create an architectonic element. One of the exercises performed in this workshop was as follows: based on the technique of origami paper folding, students made straight prisms with varied bases to create a composite solid with the juxtaposition of its lateral surfaces.

First workshop: paper folding and shape reasoning

The teaching experiences took place in 2015 and 2016 (Table 1), comprising a total of 65 students, most of them female and aged between 19 and 23 years old. The investigation of the precedents informed, on the one hand, little previous involvement of the participants with paper folding, planning and modeling of solids and origami; few students revealed having some experience with origami. On the other hand, most of the students declared dealing with electronic games, drawing, painting, and other activities that require the use of shape reasoning skills of 2D or 3D objects. In the end, it was verified that: the paper folding activity was considered of moderate difficulty; the planning and building of the solids was considered relatively easy; there was some difficulty with the origami activity. The most significant difficulty was related to the Tessellation workshop, due to the complexity of the use/employment of the technique, which was expected, considering that its development requires more time.

The results below will be reported together and illustrated by situations which were observed during the process. In order to facilitate reading, we have chosen to illustrate the results by using the presentation of works done by some students, who will be identified as numerically ordered "examples" (Ex1, Ex2 etc.).

TABLE 1 – Teaching experiences performed.

Source: Research resources, 2016.

Experiment	Períod	Participants
1	26 a 29/10/2015	Início: 6 Final: 5
2	11/11/2015	22
3	17 e 18/03; 21 e 22/03/2016	16
4	06/04/2016	21

The result of the first workshop

The "folded and perforated paper" and "planning and development of solids" activities (figures 1 and 2) were understood without any difficulties by the students. In the former activity, students folded and perforated the paper (figure 1, left). Then, they drew their folds (figure 1, center) and imagined the result by drawing how the paper would appear unfolded (figure 1, right).

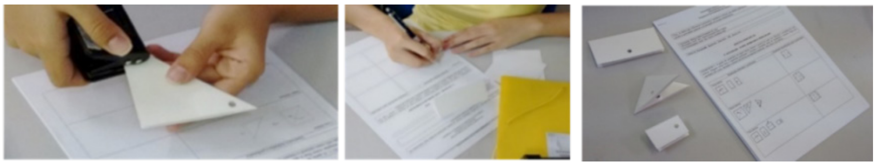


FIGURE 1 - Folded and perforated paper activity.

Source: Research archives, 2015.

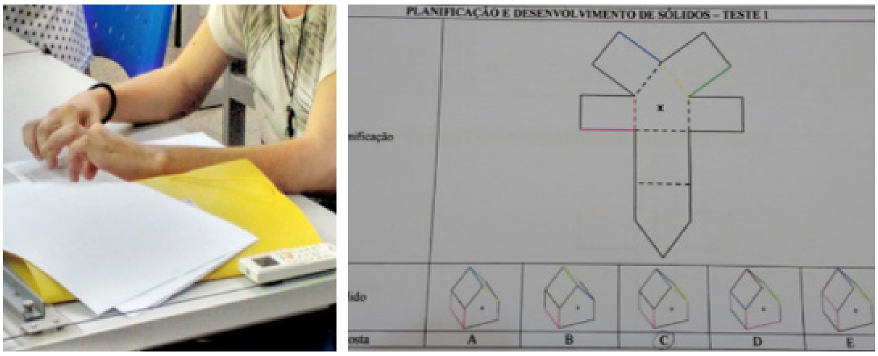


FIGURE 2 - Planning and development of solids.

Source: Research archives, 2015.

Result of the second workshop

In order to get acquainted with the symbology and the types of folds through the reading of the step-by-step of the origami diagrams (figure 2), the participants built a square-based pyramid from the diagram presented by Maria Evanir Nogueira da Silva (2009).

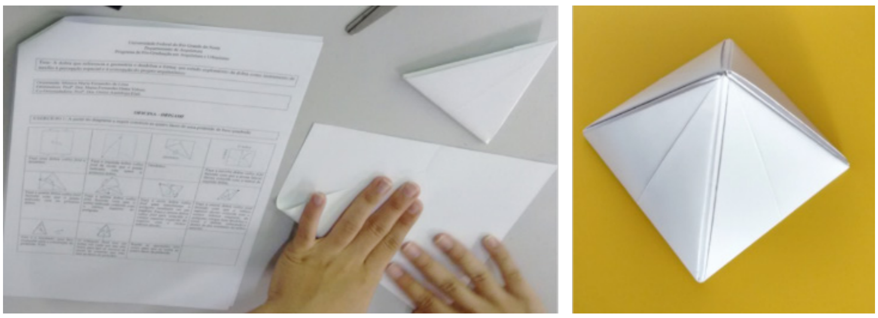


FIGURE 3 - Construction of a pyramid

Source: Research archives, 2015.

Result of the third workshop

The Tessellation workshop had as theoretical reference the book Folding Techniques for designers (Jackson, 2011), and comprised three exercises: a cylindrical section called x-form by the author, a plane ceiling through the use of two lines of V-folds, and a hyperbolic parable (figure 4).

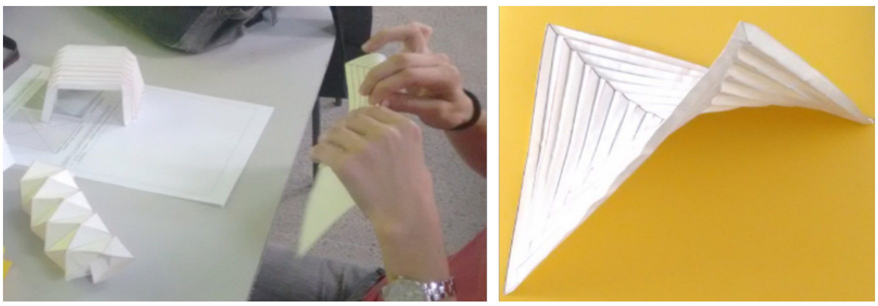


FIGURE 4- X-form, plane ceiling and hyperbolic parable.

Source: Research archives, 2015

The fourth exercise was the creation of a pattern of repetition from the Tessellation folding technique. Students were asked to describe the employed elements and geometrical operations. The process began with the definition of a motif for choosing a symmetry in order to determine the folding pattern. Afterwards, students decided the types of folds, mountain and valley, from Maekawa's[3] and Kawasaki's [4] theorems. Later, they drew their patterns on a piece of paper, which were then cut and folded. The following examples detail this exercise:

• Ex1 used the rotation symmetry to develop his Tessellation. In order to do so, he folded his pattern, analyzed it and altered it by inverting some folds, then ended up modifying the initial drawing (figure 5). As a result, the Tessellation satisfied both theorems, the difference between the valley and mountain folds was equal to 2, and the sum of the alternate angles was 180o. During this process, besides evidencing the potential of the tridimensional element as a conception tool (Costa, 2013), it was possible to observe the relationship between conception and representation (Perrone, 2014), and the reflection in the action (Schön, 2000).

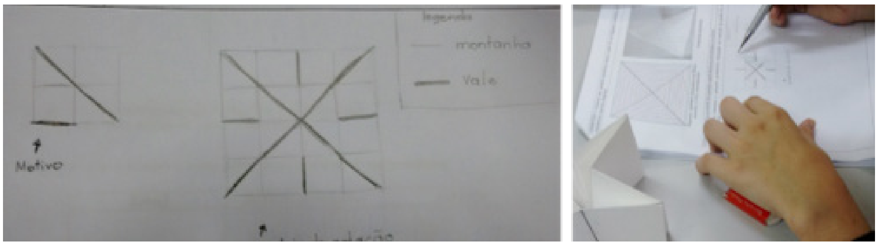


FIGURE 5- Tessellation Ex1 - Alteration of the folds.

Source: Research archives, 2015.

• Ex2 developed the Tesselation using the reflection sliding symmetry (figure 6), but the conditions of the Maekawa's and Kawasaki's theorems were not satisfied in some vortexes. Although the student was not successful in the definition of the two types of folds (mountain and valley), he also investigated other possibilities without redrawing the pattern. The investigation was performed directly on the paper when trying to fold the Tessellation by modifying or inverting the predefined folds. It can be noted, therefore, that some creases were forcibly created and that others were left unfolded (figure 7).

• Ex3 chose the rotation symmetry, but, besides rotating his motif around a central point, he decided to repeat the pattern (rotated motif), using the translation symmetry. Corroborating literature, the work showed the student's perception during the conception of the form (Boudon, 2000) and his reflection during the process (Schön, 2000), resulting in a redesign of the proposition. In this case, Kawasaki's theorem was satisfied in all vortexes, although, in some situations, Maekawa's theorem was not satisfied.

3 Tied up to the type of folds that compose a vortex, the theorem indicates that the difference between the number of valley and mountain folds is always two in any direction in any vortex.

4 This is "an important principle in the mathematics of origami [...], according to which the sum of the alternate angles formed by the folds around a single vortex in an unfolded origami will always be 180o. This holds true for every vortex on the unfolded paper of a plane figure, and not necessarily to the non-flat shapes [...]. It can be seen that we will always have an even number of angles for each vortex." (A MATEMÁTICA..., 2011, s.p.).

FIGURE 6- Reproduction of Tessellation Ex2.

Source: Research archives, 2015.

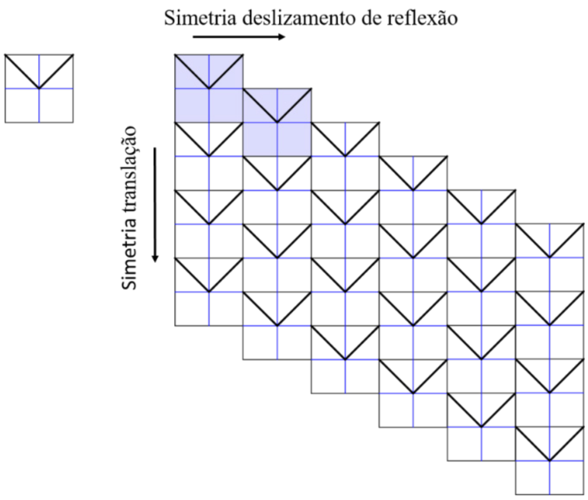
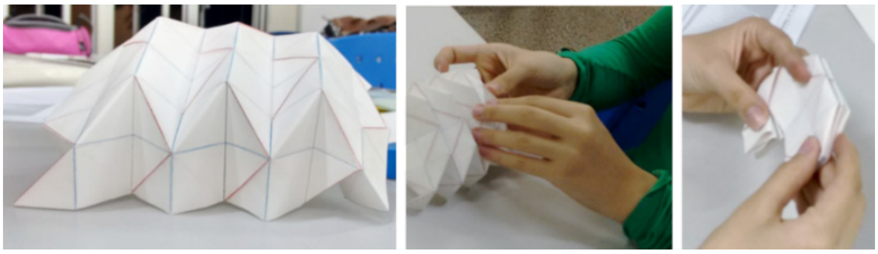


FIGURE 7- Investigation of the folds.

Source: Research archives, 2015



• With Ex4, the repetition of the model was verified through the rotation and reflection symmetries, as well as the fulfillment of the conditions ofMaekawa's and Kawasaki's theorems (figure 8).

• Ex5, at first, used reflection symmetry, as well as translation symmetry, to make the repetition of the motif in the vertical direction (figure 9). Since his work did not fulfill Maekawa's and Kawasaki's theorems, the folding was impossible in some vortexes.

FIGURE 8- Reflection and rotation.

Source: Student A4, adapted by the author, 2015.

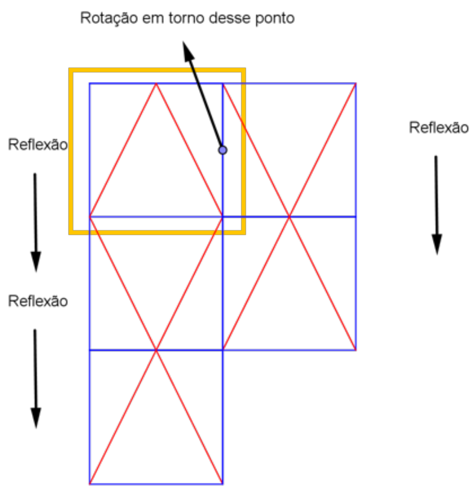
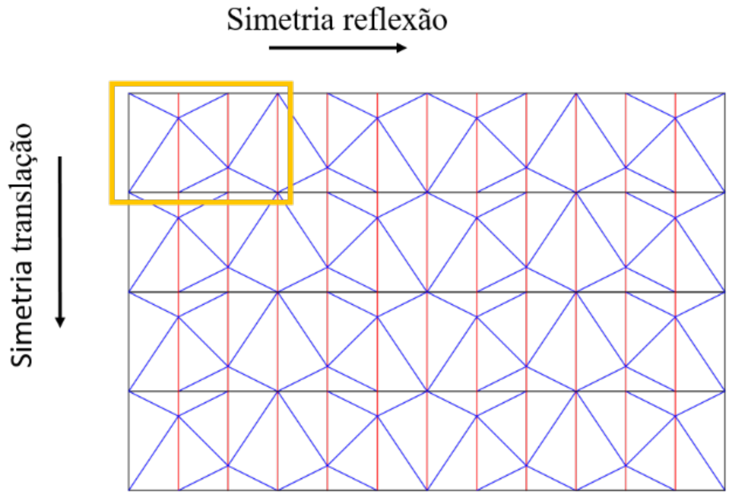


FIGURE 9- Motivo e simetrias utilizadas por Ex5.

Fonte: Aluna A5, adaptada pela autora, 2015.

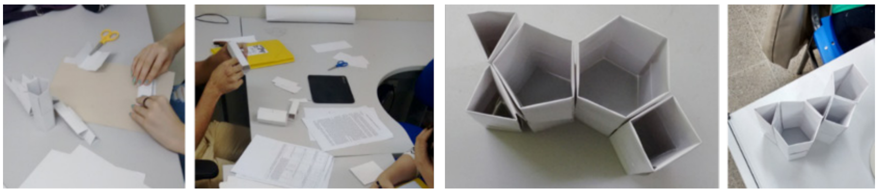


Result of the fourth workshop

In this workshop, students worked again with origami and, from diagrams, created straight prisms with varied bases which generated composite solids to subside the last activity: to develop a free-themed architectonic element (figure 10). In this activity, students were asked to explain their propositions and were informed that they could use any knowledge they had acquired in the previous exercises.

FIGURE 10- Prisms and composite solids.

Source: Research archives, 2015.



Using the aforementioned examples, which were summarized in Table 2 (below), we emphasize that:

• Ex1 developed his architectural element from the creation of a solid composed of four triangular-based prisms and one hexagonal-based prism (contents of the previous workshop), to which he added curved elements created during the workshop, explaining the work as being inspired in "a sunrise between the mountains". Therefore, he performed a process of mimetic conception, in which he made a visual analogy to natural forms.

• Ex2 used as support the activities of prism development and the Tessellation workshop. This is a significant proposition, since the student created cylinders with which he had not worked previously, besides using his folding pattern (which had not worked as a Tessellation) to create a prominent element in his composition. In propositional terms, he stated that he was "inspired by folding techniques which are reminiscent of birds". Geometry is also present in his speech: "externally, it consists of two separate buildings, whose heights are in a ratio of 1:2, which have a cylindrical shape".

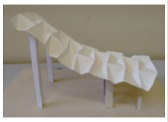
• Ex3 built an architectural element, using the content of the prism generation workshop, but did not add any new elements. He made three square-based prisms adding hyperbolic paraboloids (developed in the Tessellation workshop) as a roof, and two pentagonal-based prisms with a lower height – in his discourse, he mistakenly stated that he had made hexagons. We have noticed that the student was inspired solely by the folding techniques to construct his architectural proposition, a shopping mall.

• Ex4 was equally inspired in the folding techniques, but his proposition was richer than the previous one, since its cover is a tesselation created by the student.

In the proposition developed by Ex5, a new element was not created, corresponding to a composition of prisms of various bases. We could find mimetism in it (a visual analogy to natural forms, which was "inspired in the shape used by bees"), geometry ("six hexagons that double in size each time they move further from the entrance") and folding techniques (a sectioned volume based in the x-form).

TABLE 2 - Architectural elements explained by the students.

Source: Research archives, 2015.

STUDENTS	AUTHOR'S STATEMENT	MOCK-UPS
Ex1	"The architectural element is a tropical expo center. Inspired in a sunrise between the mountains, the element has a more open space dedicated to open-air shows or exhibitions and an internal part with several rooms."	
Ex2	"My architectural element is a school for children with autism. Externally, it consists of two separate buildings, whose heights are in a ratio of 1:2, which have a cylindrical shape, obtaining a lighter and more attractive structure for them. Besides, there is an ornament on the façade, inspired in folding techniques, which remind birds, besides being part of the roof; [...] internally, the smaller cylinder is a free space, with playrooms, toy rooms and all of the remaining constructed space has been constructed and created in order to give freedom of expression to the children. The larger cylinder is destined to the classrooms, which are quite different from the conventional ones, with open, interactive spaces."	
Ex3	"My proposition is a shopping mall, with open hexagonal parts, where t the food court and food stands are located."	
Ex4	"The triangular shaped columns are in agreement with the roof." "The X area serves as a ludic space, used for bars/lounges or the external area of a restaurant."	
Ex5	"The architectural object is composed of 6 hexagons which double in size as they move further away from the entrance, and, in the back, a seventh shape in face-to-face contact, a sectioned volume based in the x-form. Inspired in the shape used by bees, there's an hexagonal space in the center for mini open courses. The architectural element was conceived to be a center of development of space technology."	

Synthesis of the workshops

The data analysis obtained in the minicourses lead to the following conclusions:

- In the "Shape Reasoning" workshop, the "Folded and Perforated Paper" activity surpassed the expectations. It was more easily performed than expected, a fact that is confirmed by the high number of correct executions. In the "Planning and Development of a Solid", exercises 1 and 2 had 100% of correct executions, while tests 3, 4, and 5 had five correct executions each (83,33%). It may be noted, therefore, that the activity was well understood and that students presented a good level of shape reasoning.

- Similarly, no problems were detected either in the origami workshop or in the first activity of the Tessellation workshop.

- During the whole process, the greatest difficulty faced by students was the creation of a pattern of folds, the fourth activity of the aforementioned workshop, which was probably related to the short time dedicated to its execution. Perhaps the results would have been better if there had been another class destined to the correction of the patterns of folds created, reducing mistakes, particularly those related to the Mawekawa's theorem.

- The last workshop, "Development of an Architectural Element", presented satisfactory results, indicating the efficiency of the minicourse.

Considering these results, it is possible to state that the use of paper folding techniques has revealed to be an adequate tool at the beginning of the Architecture undergraduate course, to be used mainly in "Graphic Geometry 01", in order to develop shape reasoning skills in new students and, in an integrated manner, in the introductory project discipline (Space and Shape 01). In this sense, it has been noted that: (i) the "Folded and Perforated Paper" activity has proven to be important to the development of students' shape reasoning skills; (ii) the "Planning and Development of Solids" activity has proved to be potentially indicated to help students learn the content of "orthographic views of descriptive geometry" and, consequently, also facilitating the development of shape reasoning skills; (iii) these two exercises from the "Shape Reasoning" workshop are examples of possibilities of integration between "Graphic Geometry 01" and "Space and Shape 01"; and (iv), although the third workshop (Tessellation) was considered the most challenging for the students (with the highest level of difficulty), it was the one that most offered creative possibilities.

Follow-up of the workshops

The creation of the architectural element (the last exercise of the minicourses) subsided an additional exercise, applied in "Space and Shape 01" classes, the first discipline of the Architectural Project administered in this course. In order to verify the usage of the knowledge which was acquired during the minicourse in propositions elaborated in a different context, in an exercise done in class, students received pieces of paper and were asked to make a proposition for a portico to be placed at the entrance of an architectural complex. They could manipulate the material however they considered necessary: cutting, crumpling, pasting, folding etc. The experiment lasted 3 hours (the duration of the class), in which they should develop a conception model, draw the proposition (top view and schematic volumetry), and write a paragraph explaining their work and indicating the source(s) of their ideas.

CODE	MOCK-UPS	NOTES
Ex4		Continuity effect acquired with the fold made on the piece of paper.
Ex5		Although not mentioned in her statement, the student used the fold to define the pillars. Besides, the concept of continuity is observed in the roofing.
Ex7		In this case, there is also the random use of the fold. The student achieved the continuity effect acquired with the fold in the paper while aiming at disrupting its rigidity.
Ex14		The folding that has defined the cone is emphasized.
Ex20		Continuity effect obtained with the fold on the piece of paper.
Ex21		In this example, the folds were represented by the valley and mountain folds.

TABLE 3 - Random use of folds in exercise G.

Source: Research archives, 2016.

Conclusions

The present research has shown that the teaching of "Paper Folding Techniques" is indicated to fulfill the purpose of introducing the student to the exercise of architectural conception from the concept of folds, notably through exercises of visualization and shape creation, like the ones presented in this article. It can also be noted that students may be introduced to this universe not only regarding the regular syllabus of “Representation and Language” areas, but also in a more informal way, such as minicourses or workshops.

In this field, it is worth emphasizing the importance of the use of mock-ups created manually (with paper, styrofoam or other materials) in the activities with beginner students in the Architecture and Urbanism undergraduate degree courses. That resource encourages beginner students to express their ideas in a moment in which mastering techniques of representation and abstraction necessary to the act of creation are still incipient. Therefore, in this phase of the course, choosing to value concrete reasoning skills through paper manipulation, that is, using paper folding to create an architectural element, has proven to be an adequate didactic-propaedeutic experience, especially when it comes to introducing students to the Architectural Project.

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