Levels of creativity in architectural education

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ABSTRACT: Architectural design combines engineering science and art, thus stimulating creativity is a challenge in the didactic process. There are various levels of creativity that can be attained through architectural education. *From idea to architecture* (FITA) is a teaching method based on metaphorical and analogical reasoning that was developed, implemented and tested during architectural design classes in the Faculty of Architecture at Gdańsk University of Technology. Gdańsk, Poland. Four components of the FITA method: predesign, design, research and communication, were examined. To evaluate the suitability of the method a *p-survey* and an *e-survey* were used. The p-survey was intended to investigate teachers' and students' preferences within architectural design studios and to indicate a penchant for designing based on the initial idea among both groups. The next survey was focused on the FITA assessment among students and their preferences for starting points of design, considering the students' creativity level checked through the test for creative thinking - drawing production (TCT-DP). Findings indicate that the FITA method positively influences students' creativity at many levels and allows them to see compositional analogies. The TCT-DP results show that this method is mostly beneficial for students with an average level of creativity.

Keywords: Architectural design education, educational strategies, creative thinking, metaphorical reasoning, TCT-DP

INTRODUCTION

Teaching architectural design requires the teacher to convey engineering knowledge and to stimulate students' creativity during the design process at many levels. Creativity can be considered in the light of different phases of the creative process. These stages can be referred to after Kneller as preparation, incubation, illumination and verification [1]. Within architectural design classes, every conceptual project is a proposition that must accommodate specific site conditions, surrounding architecture, the local plan and the needs of future users. Hence, creative thinking is a requirement at all stages of the project up to the final design. Research on creativity in architectural education is crucial in terms of structuring and assessing creative processes, and in the field of design strategies and methods [2][3], new educational strategies, opening frontier teaching and speculative design for sustainable cities [4], and interdisciplinary studies for sustainable development [5].

Simultaneously, the development of digital tools creates an augmented environment for creativity and teaching, and it opens the discussion about the role of computational design, virtual reality, media architecture, interactive solutions, immersive platforms for the visualisations of the projects, and other digital tools in the educating process of future architects [6-8]. This does not mean, however, that stimulating creativity becomes irrelevant - on the contrary, it is even more relevant due to the increasingly complex range of challenges facing the future architect. The focus of this article is a method referred to as *from idea to architecture* (FITA), based on creative thinking, which was developed, introduced and tested during several teaching classes at the Faculty of Architecture (FA) at Gdańsk University of Technology (Gdańsk Tech), Poland. Below, it is shown how the FITA was found to impact the design process and to stimulate students' creativity.

MULTIFACETED CREATIVITY APPROACH WITHIN ARCHITECTURAL DESIGN

Amabile points to four key components of creativity: skills and knowledge, the creation process, environments and external motivators, and intrinsic motivation [9]. One can see here some analogies compared to three basic components of education in architecture, perceived considering knowledge, skills and design, equated with creativity [10]. Moreover, creativity can also be associated with personal competencies [11]. Suh and Cho proposed the synthesis of these approaches, linking creativity not only with the design phase, but also the individual cognitive styles of students. They showed stronger creativity in the initial phase among intuitive students, and increased creativity among adaptive and more analytical students during the final phase of the design process [12]. It indicates that the methodology of classes should predict diverse tasks at different phases of the design process.

It is worth stressing that creative skills can also be developed during architectural studies due to different techniques. There are at least 30 creative methods in various phases of the creative process: problem definition, idea generation, idea selection and idea verification [1][3]. Research indicates that the method most popular among architectural design teachers around the world is one based on analogy, metaphor or association (79% in Brazil, 62% - around the world [1], 72.1% in Bratislava, Slovakia [3]).

This method assigned to the stage of idea generation is based on the association of uncommon ideas coming from other fields/domains to produce a new, innovative solution [1][3]. Moreover, giving students tasks that allow them to take an emotional approach to design related to personal design guidelines, can be an important factor to enhance their self-motivation in analogical and metaphorical reasoning in design [13]. The FITA teaching method, which is the subject of the study presented in this article, is also based on analogical and metaphorical reasoning.

Assessment of creativity during architecture design classes is a very complex issue, but it can be conducted from the perspective of the three most important factors describing creativity: fluidity, originality and flexibility. Fluidity is strictly related to the number of ideas, flexibility to the variety of ideas from one category, and originality can be described as a characteristic of their uniqueness [3][12][14]. All these three factors are important in the FITA method, but for the purpose of this article, the assessment of students' creativity was carried out quite differently and was based on the well-known test for creative thinking - drawing production (TCT-DP) by Urban and Jellen [15].

METHOD'S PRESENTATION

The FITA method was developed and tested by K. Życzkowska during pre-diploma design classes, in the 6th semester of the 1st stage studies in the Faculty of Architecture at Gdańsk Tech. The method uses analogical and metaphorical reasoning. There are four main FITA components (FC) in this method: 1) predesign (PD); 2) design (D); 3) research (R); and 4) communication (C), including presentation, discussion and evaluation. The first and second elements (PD, D) are the sequential phases of the design process. The other components (R, C) constitute layers occurring in both stages in different configurations.

The FITA method is based on the students' choice regarding the initial idea to enhance their self-motivation and leads them up to the final design. The initial idea due to the FITA method may be shaped in any context - e.g. an idea in the context of a pandemic, sustainable city, friendliness of space or cultural context - a movie-based idea or an idea based on a work of art. All of these topics were implemented during the classes conducted using the FITA method for engineering diplomas.

The starting point for this study was a pilot survey called a p- (*pilot*) survey in the FA at Gdańsk Tech. It examined preferences of the teachers and students in terms of architectural design classes, checking their interest in the initial idea. In total, 25 teachers of architectural design and 95 FA students participated in the p-survey. To verify the usefulness of the FITA method, an e- (*evaluation*) survey was conducted among members of three editions of pre-diploma design classes. Thirty-five students answered the e-survey, which constitutes 89 percent of the total number of students taking part in the classes in 2021, 2022 and 2023. The results of the e-survey have been compared with the TCT-DP results, and will be elaborated on later in this article.

The TCT-DP is based on a drawing containing a big square frame and five other graphic elements. The test was designed to allow for completing the drawing in many ways, starting from a fairly conventional manner - through simple associations with given graphic elements or through original, unconventional interpretation of the presented figural fragments - depending on the degree of creativity of a person. The TCT-DP allows for checking creativity across 14 criteria; however, they cannot be considered separately [14]. In this study, also student preferences have been examined for the starting points of the design process, considering the personal level of creativity in view of the TCT-DP. The TCT-DP was conducted by B. Krawczyk-Bryłka, a psychologist from the Faculty of Management and Economics at Gdańsk Tech.

RESULTS OF THE P-SURVEY - THE PREFERABLE INITIAL IDEA IN ARCHITECTURAL DESIGN STUDIOS

The results of the p-survey show that the method of using an initial idea during the architectural design classes, which can be associated with the analogy/metaphor method, is popular among 68 percent of the teachers of Gdańsk Tech, which confirms the global trend. All starting points used for architectural design classes are presented in Table 1.

Table 1: Teachers' and students' preferred choice of starting points.

	Question to the teachers (T)	T: Do you encourage students to start designing with…? (mark on the list, multiple choice)						
	Question to the students (S)	S: Do you prefer to start the design process with…? (mark on the list, select the most suitable answer)						
No	List of starting points	T (%)	S (p-survey) (%)					
		Y	DN	RN	HS	RY	DY	GY
1	Initial idea	68.0	2.1	5.3	12.6	31.6	48.4	80.0

2	Mock-up	48.0	36.8	38.9	12.6	9.5	2.1	11.6
3	Sketches	40.0	3.2	11.6	14.7	31.6	38.9	70.5
4	Forming the functional	36.0	3.2	3.2	27.4	48.4	17.9	66.3
5	Ideogram	36.0	12.6	28.4	20.0	20.0	18.9	38.9
6	Analysis using digital tools	28.0	5.3	16.8	32.6	33.7	11.6	45.3
7	Functional diagram	20.0	4.2	12.6	24.2	42.1	16.8	58.9
8	Idea for the façade	12.0	24.2	41.1	21.1	10.5	3.2	13.7
9	Surveying residents	8.0	23.2	27.4	29.5	14.7	5.3	20.0
10	Site analysis	(100.0)		7.4	8.4	48.4	35.8	84.2
11	Architectural inspirations	(92.0)	4.2	6.3	7.4	36.8	45.3	82.1
12	Other	24.0	15.8	13.7	55.8	8.4	6.3	14.7

Legend: DN - definitely not, RN - rather not, HS - hard to say, RY - rather yes, DY - definitely yes, GY - generally yes, Y - yes

The p-survey results demonstrate that the initial idea as a starting point is even more popular among the students (80 percent) than the teachers (68 percent). It is worth stressing that there is a significant difference in opinions among the teachers and students regarding the mock-up. Although the teachers rather prefer to start with a mock-up (48 percent), the students mostly do not share this preference (75.7 percent). In contrast, the students prefer to start with the programme and functional layout of the building, which is not so preferable among the teachers. However, as the results show, there is a giant potential in using the initial idea because of a penchant for designing based on the initial idea among both of these groups. Site analysis (no. 10) was not included in the teachers' survey because it is an obligatory component of the classes. Searching for inspirations (no. 11) was also not mentioned in the teachers' survey, because it is an attitude connected to students; however, 92 percent of the teachers admitted that they use analysis of existing architectural objects during their classes.

FITA METHOD'S APPLICATION AND ITS VERIFICATION BY THE E-SURVEY

In the FITA method, *predesign* is the very creative phase of the design process because it is the time for the descriptive formulation of the idea, illustrating it by an ideogram and creating several variants of the abstract dimensional forms to fulfil the criterion of flexibility (Table 2, PD.1, PD.2, PD.3). An example of developing an idea derived from the pandemic time is presented in Figure 1 and Figure 2. The idea to create a *breathing space* was developed in the external structure of balconies connecting separate segments of a dormitory, which resembled the vessels of the lung or a tree branch.

a) b)

Figure 1: The design process and idea in the context of the pandemic time (student: Wiktoria Kalińska).

In order to verify the usefulness of the FITA method, students were asked in what way they found the main elements of the FITA method useful and inspiring (e-survey). The results of the e-survey are presented in Table 2.

Table 2: Assessment of the elements included in the classes conducted with the FITA method.

FC symbol	Elements of the classes with the FITA method	Responses (%)					
		No		Hard to say		Yes	
		U	I	U	I	U	I
	Phase I - Predesign						
R.1	Situation analysis	2.85	22.90	5.70	17.10	91.45	60.00
R.2	Local plan analysis	2.85	17.10	2.85	22.90	94.30	60.00
PD.1	Descriptive formulating of the initial idea	20.00	11.40	5.70	20.00	74.30	68.60
PD.2	Ideogram as an illustration of the initial idea	20.00	17.10	5.70	8.60	74.30	74.30
PD.3	Mock-ups - an abstract form	42.80	48.55	22.90	11.45	34.30	40.00
	Phase II - Design						
D.1	Mock-ups - architectural structure	57.10	54.30	11.45	5.70	31.45	40.00

D.2	Working on a digital model	5.70	5.70	2.85	20.00	91.45	74.30
R.3	Own search for architectural inspiration	5.70	5.70	8.60	5.70	85.70	88.60
R.4	The group catalogue of functional typologies	14.30	25.70	17.10	17.10	68.60	62.90
R.5	The group catalogue of façade typologies	40.00	25.70	14.30	25.70	45.70	48.60
D.3	Functional modification based on the initial idea	8.55	8.55	11.45	11.45	80.0	80.0
D.4	Modification of the form based on the initial idea	8.55	8.55	11.45	8.55	80.0	82.9
	Phase I and Phase II						
C.1	Consultations with the teacher	2.85	5.70	5.70	0.00	91.45	94.30
C.2	Discussing the project with a colleague	11.45	11.45	17.10	14.30	71.45	74.25
C.3	Group discussion based on architectural criteria	14.30	17.10	25.70	31.40	60.0	51.50

Legend: U - useful, I - inspiring, symbol of FITA components - described by shortcuts of FC (R - research, PD - predesign, D - design, E - communication) and ordinal number of elements within this FC

Two tasks of the predesign phase - situation analysis and analysis of the local plan (Table 2, R.1-R.2), as well as the tasks related to formulating and illustrating the initial idea were evaluated by the students as highly useful in the e-survey (Table 2, PD.1-PD.2). However, the research results indicate some differences in perceiving mock-ups among students and the teacher. Although the students do not highly appreciate this task, from the teacher's perspective, this task enabled an interesting starting point for the development of the architectural form.

Creative thinking develops not only in the predesign phase, but also at that phase of design, when an architectural structure is modified, up to the final design (Table, D1–D4). All iterations related to the modification of the functional layout and form of the building in regard to the initial idea were assessed really high (Table 2, D3-D4). At this stage, analogical thinking is useful in architectural case studies. Even if students do not appreciate teamwork in creating architectural typologies (Table 2, R.4-R.5), it gives them a wider scope of examples to capture their imagination and systematise knowledge, and in the end, they found the tasks quite useful. However, a successful design process always demands good communication with the teacher and colleagues in both phases of the process (Table 2, C.1-C.3), allowing for viewing problems from multiple perspectives. The conducted e-surveys show that future architects find consultation with a teacher to be a critical factor that stimulates their creativity (94.3 percent) (Table 2, C1).

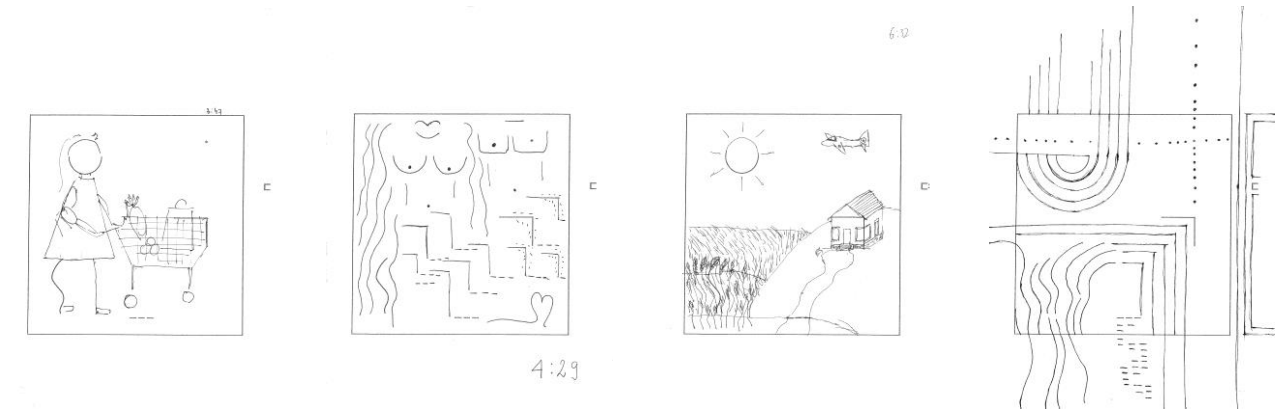
The results of the e-survey were also correlated with the results of the TCT-DP (see Table 3, Statement 5). The average scores of the creativity level in the TCT-DP in the three surveyed groups over the years 2021, 2022 and 2023 were 42.6, 33.9, 44.4, respectively. The responses of the e-survey were, therefore, divided into three groups depending on the score: A (24-37 points), B (38-43 points), C (44-59 points) as shown in Table 3, and drawings from different groups of scores are presented in Figure 2.

Table 3: Results of the TCT-DP compared with the e-survey and p-survey responses - Statement 5.

Groups	A (24–37 points)			B (38–43 points)			C (44–59 points)		
Responses	yes	hard to	no	yes	hard to	no	yes	hard to	no
Statement 1	1. A descriptive representation of the idea was more useful than an ideogram.								
Responses	41.7	25.0	33.3	38.5	15.4	46.1	37.5	25.0	37.5
Statement 2	2. An ideogram was more useful than a descriptive representation of the idea.								
Responses	58.3	25.0	16.6	38.5	30.75	30.75	37.5	37.5	25.0
Statement 3	3. The initial idea helped me at the initial design stage (creating an abstract form).								
Responses	100			76.9	15.4	7.7	100		
Statement 4	4. The initial idea helped me at a later design stage (modifying of arch. structure).								
Responses	58.4	16.6	25.0	69.2	7.7	23.1	75.0	12.5	12.5
Statement 5	5. Do you prefer to start the design process with…? (mark the right answer).								
Situation analysis	83.4	16.6		100			85.7		14.3
Local plan analysis	83.4	16.6		85.7		14.3	85.7		14.3
Site trip	100			85.7		14.3	42.8		57.2
Surveying residents	33.4	16.6	50.0	42.85	14.3	42.85	14.3	28.6	57.1
Sketches	100			85.7		14.3	85.7	14.3	
Functional diagrams	16.6	33.3	50.0	85.7		14.3	57.2		42.8
Mock-up	33.4	33.3	33.3	28.6	42.8	28.6		28.6	71.4
Digital model	33.3	16.6	50.0	57.1	14.3	28.6	57.2		42.8
Initial idea	50.0	33.3	16.6	71.4	14.3	14.3	57.1	28.6	14.3
Ideogram	16.6	50.0	33.3	71.4		28.6	28.6		71.4
Defining the problem	100			100			85.7	14.3	
Defining the future users	100			85.7	14.3		85.7		14.3
Architectural inspirations	83.4	16.6		71.4	14.3	14.3	85.7	14.3	
Other		33.3	50.0	28.6	14.3	57.1	28.6	42.8	28.6

Group A constituted 26.6 percent of the whole surveyed group, group B - 40.6 percent and group C - 21.8 percent. Based on the results of the TCT-DP and the e-survey, one can observe that students from group B and group C found the initial idea more useful at a later stage of the design process than students from group A (Table 3, Statement 4), but generally, it was helpful in all three groups, especially at the initial design phase (Table 3, Statement 3). Moreover,

the students from group A found an ideogram more helpful than a descriptive representation of the initial idea. In turn, the other groups could not clearly point out which way of representation of the initial idea was more useful or inspiring.



a) b) c) d)

Figure 2: Drawings from the test for creative thinking - drawing production (TCT-DP) - from the lowest score on the left up to the highest on the right (24 points, 36 points, 39 points, 56 points).

The obtained results confirm the positive assumption of the FITA method concerning the use of a graphical and descriptive representation of the method as a complimentary tool, especially in a group of highly creative students. The weakness of the evaluation method is that all the surveys were anonymous, so there was no possibility to compare the results of the classes and the progress of students from the position of a teacher considering the results of the TCT-DP. However, it was sufficient for the assessment of the FITA method through the e-survey, considering the TCT-DP, from the perspective of the students.

The results of the TCT-DP were also considered in terms of favourite *starting points* of the design processes, which is the continuation of the study conducted in the p-survey (Table 1). All the groups preferred to start with situation analysis, local plan analysis, sketches, searching for architectural inspirations, and defining the problem of the place and its future users. The difference in opinion is visible in terms of the site trip, which seems beneficial only for group A and group B. Moreover, group B and group C pointed out that functional diagrams were not in the scope of interests of group A. Group B was also mostly oriented on the initial idea and the ideogram compared to group C and group A. It indicates that the FITA method is mostly suitable for group B which represented the average level of creativity. However, as many as 75 percent of all surveyed students (in the e-survey) admitted that the initial idea helped them in designing, so the main goal of the method was achieved.

DISCUSSION AND CONCLUSIONS

From idea to architecture is a teaching method that, as has been shown, stimulates creativity among architectural design classes at many levels. It offers an axis of project development that supports student-teacher communication and offers a personal environment for formulating an initial idea, which positively influences students' motivation to design. A graphical and descriptive representation of the initial idea allows to develop such creativity factors as fluidity, flexibility and originality during the preparation of different variants of abstract forms in the predesign phase and creative modifications of architectural structures during the design phase. An abstract environment for metaphorical and analogical reasoning makes the design process inspiring. Thus, it can be concluded that this method has a positive impact on students' creativity, which is confirmed by the conducted e-survey.

Moreover, the FITA method allows students to see compositional analogies in existing architectural realisations and facilitates the conscious use of certain means of expression in their design. One can notice some analogies of that process to the idea of artificial intelligence based on big databases, and definitely all the typologies collected during the research phase could be used for that need. However, it is the initial idea that determines the path of the design process, and this makes the final design original and dependent on critical thinking at different phases.

The assessment of the FITA method, in view of the students' level of creativity, checked by the TCT-DP shows that this method is mainly beneficial for students with an average level of creativity. It should be again emphasised that the TCT-DP is a universal method to check the creativity level, but that creativity is a really capacious concept, related to cultural and individual backgrounds, and also connected to motivation. However, these results can be used to better adapt the method to different profiles of students, especially from the groups of the lowest and highest levels of creativity, to better stimulate their creativity and fulfil their preferences.

The challenge for future development of this method is also the digitalisation of across professions, and the use of digital tools to simulate spontaneous work on the mock-ups, and the use of artificial intelligence at the phase of functional and aesthetic typologies to better define the final design. Regardless of the future direction of teaching

methodologies, fostering creativity and critical thinking should not be overlooked. Educating architects who are capable of generating diverse designs and are aware of the ramifications of their design choices is essential.

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BIOGRAPHIES

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