The influence of academic competitions on the development of competencies of future Masters of engineering

Katarzyna Hodor

Cracow University of Technology
Kraków, Poland

ABSTRACT: Academic contests addressed to students are an important activity that aids in developing extracurricular competencies. They are addressed to people who represent various academic institutions and attend Bachelor's, Master's and doctoral courses. In the applicable subject field, the Chair of Landscape Architecture in the Faculty of Architecture at Cracow University of Technology, Kraków, Poland, has been organising international and Polish conferences for twenty-seven years, while student contests for six. These contests confront students with research options in the field of landscape architecture. This article presents an educational method directed at students interested in this field, as an answer to the previously detected educational gaps. The method described here allows for research engagement and serves as an introduction to the academic path. This method may contribute to raising interest in academic work among students and allows for gaining additional competencies and knowledge connected with academic skills.

INTRODUCTION

The process of teaching first- and second-cycle students is associated with module classes. Attaining additional competencies can take on the form of students engaging in academic club activities, design workshops, voluntary work, internships and competitions. Cracow University of Technology, Kraków, Poland (CUT) provides a great deal of aid in the search for extracurricular activities organised both in Poland and abroad. This article presents a teaching method that was first applied in the Faculty of Architecture (FA-CUT), in 2013 in a cyclical international academic conference.

The method is based on four stages that allow students to expand their interests and enhance their competencies. It can broaden the skillset of future graduates, through development opportunities in academic research during tertiary-level education.

The academic conference series referred to here, focuses on a broad outlook on landscape architecture and has been running for twenty-seven years. The goal of these conferences is to exchange academic experience in historical dendrology, garden design and landscape architecture, and the popularisation of knowledge in these fields. The conferences are run as annual meetings of Polish and foreign researchers, students, representatives of cities, municipalities and local and state-level conservation institutions. Their educational mission is based on building awareness and sharing academic achievements with young scholars.

The organisation of the conferences and their accompanying academic competitions is supported by the Rector of the CUT and the Dean of the FA-CUT, as well as trade, academic, conservatories and museum organisations.

The overarching idea of treating conferences as a teaching experiment stemmed from a clearly visible need to engage students in extracurricular development. On examination of the students' educational path, a clear need for the development of academic competencies in a cyclical manner, free of charge, was identified. The extension and opening up of opportunities for students from other universities to present their work allowed the initial group of respondents to grow, thus increasing the reach of the initiative. At the time when the educational method based on a cyclical extracurricular academic competition was introduced, additional competencies that students could gain were defined. An analysis of the current educational outcomes of the landscape architecture course allowed for an identification of gaps, thereby justifying the introduction of conference participation as a remedial measure.

TEACHING METHODS: NEEDS, IDENTIFICATION, MEASURES

University-level education is based on the attainment of competencies by students in three categories: abilities, knowledge and social skills [1]. The FA-CUT offers first- and second-cycle courses: Bachelor's and Master's, along with providing an opportunity to obtain more knowledge via a PhD course - taught at the doctoral school. The educational

method discussed here was developed based on the State Accreditation Commission's guidelines and standards, combined with those of the International Federation of Landscape Architects, Europe (IFLA Europe) [2]. Original, integrated design studio modules based on innovative methods focused on supporting the natural environment play a large role in teaching [3][4]. Apart from obligatory elements, future graduates are given the opportunity to engage in extracurricular activity. As pointed out earlier, student competitions significantly support the didactic process [5]. The idea of getting students involved in extracurricular activities has always been a key part of supplementing the teaching process. In the method proposed, it takes place across four stages: preparing a presentation proposal with the aid of an academic tutor, delivery of the presentation at a conference, the presentation's assessment by a jury and a subsequent publication offer in a peer-reviewed journal for the best presentations.

Academic competitions contribute to gaining unique competencies that are unattainable via standard university courses. An analysis of outcomes for the first- and second-cycle courses was performed. The first-cycle course has 23 outcomes associated with subject knowledge, 26 outcomes associated with skills and 13 with social competencies. The second-cycle course has 15 outcomes associated with subject knowledge, 22 with skills and 7 with social competencies. Expected competencies to be gained by students via an academic competition were compared and an analysis of gaps in the current educational outcomes was performed. A set of conclusions was formulated and remedial measures were proposed (see Table 1 and its Supplement).

Table 1: Analysis of needs, identification of gaps in the current educational outcomes and planned remedial measures.

Competency group	Competencies to be gained via the proposed educational method (academic competition)	Identification of gaps in attaining competencies throughout the university course		Identification results	Proposed remedial measures
		First-cycle course - planned effects tied with educational outcomes	Second-cycle course - planned effects tied with educational outcomes		
Knowledge (what the graduate should know and understand)	Extend the scope of extracurricular knowledge concerning the subject of study	None	2 outcomes in 3 modules	Low-level attainment	Enhancing measures that provide greater insight into the subject of study at a theoretical level
Skills (what the graduate should be able to do)	Ability to conduct research and present its outcomes in a communicative manner, as expected at an academic conference, at a practical level, inventive thinking	3 outcomes in 4 modules	2 outcomes in 1 module	Medium-level attainment, without incorporating the aspects of specific precepts of academic and competition work	Mastery of implementation - enhancement of the ability to conduct academic research, prepare one's research, presentation and a publication offer during stage I
Social competencies (what the graduate should be prepared to do)	Critical thinking based on metacognition, independent goal-setting, progressive self-monitoring and fostering the feeling of one's own effectiveness	2 outcomes in 2 modules	1 outcome in 1 module	Medium-level attainment, without incorporating the aspects of academic work	Allowing for critical thinking based on empirical action and self-awareness, coming into contact with a diverse range of opinions - confrontation with a group, self-awareness (self-image)

Table 1: Supplement: Description of expected outcomes for selected modules.

Course cycle - module	Outcome 1	Outcome 2	Outcome 3
First - 4 modules (54 in total in first cycle)	Critical assessment of knowledge and content encountered, effective use of imagination and intuition in creative work	Ability to obtain essential, task-specific information from various sources	Ability to obtain a diverse range of data about an area using essential research methods, tools and techniques
First - 2 modules	Awareness of the need to self-educate and improve	Preparedness to present one's work and formulate	

	in the selected field	assumptions and design solutions, ability to back one's views with arguments and engage in professional polemics	
Second - 3 modules (24 in total in second cycle)	Familiarity with the precepts and methods of academic research applied in landscape architecture and the associated fields	Familiarity with contemporary theoretical and practical studies on landscape conservation and design	
Second - 1 module	Ability to plan and conduct research in landscape architecture and the associated fields, selecting task-appropriate research methods, and formulating and testing hypotheses	Applying specialist terminology, preparing written sections of design documentation, research presentations and papers, publicly presenting the outcomes of one's work and participating in a debate or discussion	
Second - 1 module	Ability to make practical use of contemporary trade and academic literature, and understanding the need to continuously update the acquired knowledge and to engage in lifelong learning		

EDUCATIONAL METHOD, STAGES

The four stages of the educational method allow the extension of the graduate pattern with important additional competencies, as specified in the identification section of Table 1. Below is a presentation of each of the method's stages, along with their detailed overview.

Stage I - Co-operation with an Academic Tutor, Research

The first stage concerns joint student-tutor activity. Aid in research and proper substantive groundwork allow for preparing the material for presentation. During the first edition, the organisers decided on the requirement of obligatory recommendation by a tutor (a researcher), to be attached to the conference application. This enabled an initial verification of the presentation. The stage applies the tutoring model. Two-person teams are allowed, including teams composed of students from different universities. The key here is tutor-student experience exchange and independence in research. Experience gained during the six editions of the conference showed that the subjects discussed belong to three problem groups. These are comparative studies (40%), reviews (25%) and original research, frequently based on thesis projects (35%). To exclude subject matter outside the research scope, all participants are informed of the assessment criteria in advance (methods, research objective).

Stage II - Presentation

Stage II - Educational activities involve presenting the material by participants. During conferences, open to students, they become aware of the academic skills and presentation abilities of Polish and foreign scholars.

Stage III - Assessment

The third stage is based on assessing the presentation using an evaluation sheet. The criteria presented in the table below are assessed individually (see Table 2).

Table 2: Presentation evaluation sheet used in the method.

Item no.	Criteria	Points				
1.	Presentation's pacing/schedule	-	1	2	3	-
2.	Presentation's quality	1	2	3	4	5
3.	Accuracy of research method and tool selection	-	1	2	3	-
4.	Originality of the problem, hypothesis and/or research method	1	2	3	4	5
5.	Subject formulation and setting objectives	1	2	3	4	5
	Final mark - point total					

A competition jury comprising researchers from various academic institutions and invited guests (representatives of external institutions that co-operate with the Chair, such as the Cracow Municipal Greenery Authority or the Spatial Planning Bureau) assesses the presentation. The invitation of 1-2 external members into the jury appears to be an added value of the assessment, which is observable in the questions the presenters are asked and the closed discussions the jury engages in during the assessment. Five aspects are graded, associated with the presentation of each research subject and its formulation. The first two aspects are associated with the technicalities of each presentation (its schedule and quality). The detailed point scores oscillate between 1-3 and 1-5. The total amount of points collected from all jury members is used to evaluate all participants. Point ratings within the 1-3 range are assigned to the presentation's pacing/structure and the accuracy of research method and tool selection, as it is assumed that competition participants can make errors concerning these matters due to limited experience.

Based on the scores from six academic competitions, the strengths and weakness of student presentations were analysed as part of stage II, and are presented in Figure 1.

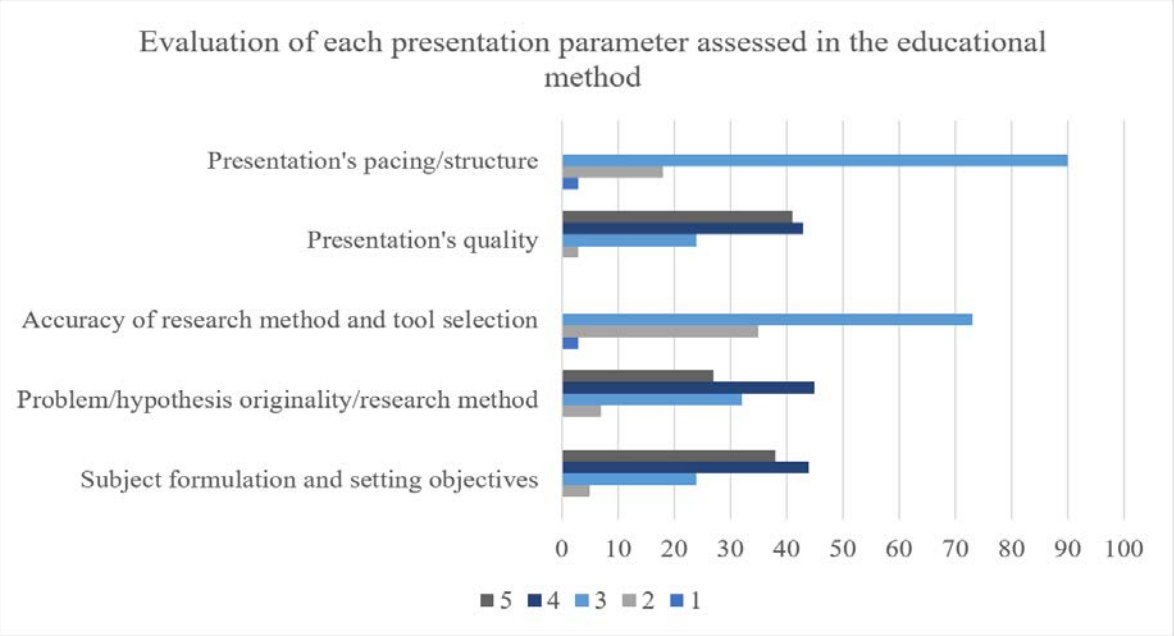

Figure 1: Evaluation of each student's presentation - assessment parameters based on scores from 2015.

Based on an evaluation performed in 2015, it was found that 40% of the participants formulated their subject and goals in a satisfactory manner (see Figure 1). The originality of research problems and methods were rated as very good for 24% of the participants, 29% were rated as poor and 6% were rated as very poor. The best ratings were given to students for their presentation's pacing/structure, as 90% of the participants were given the highest rating. The accuracy of the research method and tool selection was rated as very good in the case of 66% of the participants. The formulation of the subject and goals of the presentation was rated as very good for 34% of the presenters, 40% achieved an average score and 22% achieved a satisfactory score.

Continuous evaluation has led to the method's modification in terms of participant selection. In 2014, PhD students could enter the competition, thus creating a clear difference in the quality between third-cycle student presentations and those of participants from earlier cycles. In 2018, doctoral students were placed in the main presenter group.

The evaluation showed that target parameters concerning the quality of the presentations were achieved. There were no unsatisfactory presentations in the group, while very poor presentations accounted for 6% of the total. The yearly monitoring of outcomes allows for the continuous adaptation of the proposed method to changing educational conditions.

Stage IV - Publication (Elite Stage, Restricted for Laureates)

During the final stage, the method is addressed to a small group of students who have achieved the highest scores during stage III. They are awarded with the opportunity to publish their research. For years, the selected papers were peer-reviewed and edited following the guidelines of scientific journals depending on the given edition. Over six years, 15% of the research presented by students was published.

OVERVIEW OF OBJECTIVES, EXPERIENCES AND OUTCOMES

The objective of the outlined educational method applied as part of the statutory operations of the Chair of Landscape Architecture of the FA-CUT is to enhance the abilities of students, show them the course of academic research and confront them with other researchers. It concerns students interested in extracurricular development (see Table 3).

The educational objective, experience, outcome and tutor involvement across each of the method's stages have been identified below.

Table 3: Overview of objectives, experiences and outcomes at each stage of the method.

	Educational objective	Educational experience	Educational outcome	Tutor involvement
Stage I	Development of the ability to prepare a presentation of academic research at a theoretical level	The student comes into contact with research methodology, academic presentations and an international community of researchers	The student masters performing research, delivering a presentation and writing an academic paper	Average
Stage II	Ability to present research in a communicative manner as defined for the academic conference - practical skill	Application - enhancement of knowledge based on substantive discussions	The student masters the application - develops the ability to perform academic research gained during stage I	None
Stage III	The student is familiarised with opportunities for research and the research methods used by experienced researchers	The student is aware of a multi-dimensional assessment of their presentation, self-assessment in comparison to other participants and critique	The student gains the ability to formulate conclusions and further masters previously gained skills	None
Stage IV	Preparation of an academic publication	The student becomes familiar with the methodology of writing and editing research papers and masters the application of a proper method	The student gains the ability to properly respond to peer reviews and prepare research material	Average

Academic competitions contribute to attaining unique competencies that cannot otherwise be obtained via a university course. The competition organised by the FA-CUT is freely accessible and open to students of all years, regardless of the course cycle, and is cyclical, which allows for preparing in advance for the subsequent edition. The competition has a country-wide scope and always focuses on relevant topics concerning greenery and landscape architecture.

In the author's opinion, the uniqueness of the method's outcomes is based on: combining theoretical knowledge with the empirical aspect of research, documenting and presenting findings, and critical thinking, which develops an additional group of competencies. It also allows for becoming aware of a broad range of juror opinions and those of researchers from around the world, and confronting one's views with a larger group.

Table 4: Outcome evaluation in two dimensions.

	Short-term educational outcome	Long-term educational outcome
Knowledge	Medium	Medium
Skills	High	Medium
Social competencies	High	High

The educational outcomes in terms of extracurricular competencies attained by students in association with the proposed method were measured over the short and long term (see Table 4). The short-term measurement was taken during the evaluation of the method's third stage. The percentage share of participants with the highest performance was assessed and deemed to be the weakest indicator. The long-term measurement involved observing the careers of specific graduates. The monitoring focused on the post-graduation careers of competition participants, the number of participants who continued their studies via third-cycle courses or who developed research interests that used the abilities they had obtained in later work, and who used academic conferences as valuable sources of knowledge about contemporary studies and the various aspects of their application. Overall, the outcomes showed that the objectives concerning the method's educational outcomes were achieved.

Monitoring has shown that around 10% of students elects to pursue PhD courses, while 8% regularly attend or present their research at conferences.

DISCUSSION

The landscape architecture course has been crystallising for the last twenty-one years. During this process, and that of the formation of curricula as a result of the activity of European associations, including IFLA Europe [6], opportunities

emerged for extracurricular educational activities targeting landscape architecture students. They were provided by local and international organisations, such as the European Council of Landscape Architecture Schools (ECLAS). Design competitions, workshops and training courses enable the attainment of various competencies that are either outside of educational standards or enhance one's existing skills [7].

Competitions also cover Bachelor's and Master's thesis projects within a similar scope at the entire FA-CUT [8]. In the teaching process, innovative methods are still searched in order to motivate students for more efficient work. Most often these are design projects [9]. The opportunity to engage in international workshops appears occasionally depending on initiatives by trade associations and inter-university contacts. Their availability is insufficient, as in 2018 only a single workshop dedicated to faculty of architecture students (for architecture and landscape architecture course students) took place, while in 2019 there were no such opportunities.

Conferences open to students include the Tygiel conference (organised since 2015), which discuss a thematically diverse group of disciplines. The thematic scope of these interdisciplinary national conferences covers a wide array of theoretical and practical problems from the technical sciences, natural sciences, humanities and social sciences. Participation in these conferences requires a fee.

A similarly broad spectrum is offered by student club competitions held by each faculty at a final inter-university stage. The research problems presented at such conferences concern extracurricular studies by students that are organised as part of the specialisation of each academic club. At the CUT, this is a competition whose final stage is a collective publication spanning all fields and faculties. This proposal differs from the proposed method in that it does not provide an opportunity to compare one's study within a specific discipline and to measure it against the work of experienced researchers.

CONCLUSIONS

Experience gained during the organisation of six editions of academic competitions shows that the opportunity for willing students to participate in extracurricular activities free of charge allows them to enhance their competencies and open up to a new educational path (third-cycle studies) and/or to improve their qualifications. It is crucial to enhance the self-education abilities of future graduates and to develop their interest in research.

Evaluation (stage III) is an important component of this method, allowing students to assess their research and presentation skills, and can act as an indicator for the organiser in terms of improving the method itself. This method can be applied to other courses and can accompany national and international conferences. It is essential to apply the method across all four of its stages, so as to properly utilise the potential of interested students. This is an important direction enabling new experiences and abilities, and can lead to the development of a broader outlook on the education process.

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