



Role of employers in the process of Civil Engineering curriculum development: A case in Poland

El papel de los empleadores en el desarrollo curricular de los Ingenieros Civiles: Un caso en Polonia

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HIGHLIGHTS

- Awareness of employers to influence the education programs is growing
- Cooperation between universities and employers has great influence on CV development
- Various forms of cooperation prepare graduates to enter the labour market

TITULARES

- Crece la concienciación de los empleadores para influir en los programas educativos
- Cooperación entre universidad y empleadores en el plan de estudios de ingeniería civil
- Diversas formas de cooperación preparan a los graduados para ingresar al mercado de trabajo.

RESUMEN

Las últimas enmiendas a la Ley de Educación Superior en Polonia han reforzado el papel y la importancia de la cooperación entre las universidades y el entorno socioeconómico. La idea de la elaboración de un currículo basado en los resultados del aprendizaje, debe facilitar la cooperación entre las universidades y los socios externos (empleadores, representantes de organizaciones profesionales, etc.) en el proceso de desarrollo de la oferta educativa. Los empresarios esperan que los graduados tengan un alto nivel de competencia que sea una síntesis de conocimientos teóricos, habilidades prácticas y rasgos personales. En su opinión, el papel del sistema educativo debe ser preparar a los graduados de manera práctica para la profesión y proporcionarles una amplia gama de habilidades profesionales. La debilidad más frecuentemente de los graduados universitarios es la falta de experiencia y de habilidades prácticas. En un principio, la participación de los empleadores en el diseño curricular fue simbólica, quizá por falta de interés, o por la necesidad de graduados con habilidades específicas para determinadas posiciones en la empresa. La participación de los empleadores en el diseño curricular y la evaluación de su calidad ha aumentado desde que los representantes de los éstos fueron incluidos en los comités de evaluación externa. Las formas más eficaces de participación de los empleadores en la creación de los planes de estudio fueron discutidas sobre la base de la ingeniería civil en la Universidad Técnica y se han desarrollado como estudios duales, estudios de posgrado comunes, pasantías, viajes técnicos, conferencias específicas, etc. Los empleadores están tomando cada vez mayor conciencia de la necesidad de su participación. Sin embargo, todavía es necesario buscar mecanismos y métodos de consulta que realmente involucren a los empleadores en la cooperación y, al mismo tiempo, no generen problemas burocráticos.

Palabras clave: *Educación universitaria, Ingeniería Civil, Empleo, Cooperación institucional, Desarrollo Curricular.*

ABSTRACT

The latest amendments to the Law on Higher Education strengthened the role and importance of cooperation between the universities and socio-economic environment. The idea of curriculum based on learning outcomes should facilitate cooperation of universities with external stakeholders (e.g. employers, representatives of professional organizations) in the process of educational offer development. The employers expect graduates to have a high level of competence that are a synthesis of theoretical knowledge, practical skills and personal features. In their opinion, the role of the education system is to prepare graduates practically for the profession and to provide them with a wide array of professional skills. Most frequently mentioned weakness of university graduates is the lack of experience and practical skills. Initially, the participation of employers in curriculum design was symbolic. It was the result of lack of interest or the requirement for graduates for very specific skills needed for a given position in the company. The participation of employers in the curriculum design and evaluation of its quality has increased since the representatives of employers were included in the external evaluation committees. The most effective forms of employers' participation in creating a curriculum of study e.g. dual study, common post-graduate study, internships, technical trips, dedicated lectures etc. were discussed on the basis of civil engineering in technical university. The participation of employers is increasingly more conscious. However, there is still a need to seek mechanisms and methods for consulting that would really involve employers into cooperation, and at the same time would not generate more red tape on any side.

Key words: *Higher education, civil engineering, stakeholders, cooperation.*

1. INTRODUCTION

The legal change of the concept of education in European countries introduced together with the European and National Qualification Frameworks [1] imposed a new approach to curricula design based on learning outcomes.

The role of higher education is not only the directional transmission of knowledge, but also equipping graduates with the skills to enable their employment [2,3]. Apart from teaching and research, the universities in the knowledge society take on the task of creating the intellectual potential, which determines the constant extension and exploitation of knowledge. Intellectual capital determines the economic development, among others, by increasing labour productivity and competitiveness of the economy. Thus, the relationships between universities and the socio-economic environment is becoming more and more intensive. The universities create their surroundings through transfer of technology and scientific staff, and through graduates preparation. The universities are responsible for educating graduates capable of performing not only highly specialized professional jobs, but also for creating new specialties appropriate to their abilities and needs of the labour market.

Currently, it is necessary to link up the concept of education at all levels and types of studies and the research activities with the goals and priorities declared in development strategy of the university, as well as with the needs of social, economic and cultural environment, in particular with the labour market, in the context of the role and position of university in the education market. Hence, the increase in the role of various stakeholders: staff, students, graduates, employers cooperating with the university, as well as the new role of institutions

dealing with accreditation and evaluation of the education quality.

The European and National Qualification Frameworks, which are the source of the generic outcomes specified for each learning outcome on the one hand, and the internal and external quality assurance systems on the other, are the guarantee that different kinds of limitations will not threaten the expectations of stakeholders involved in curriculum design in relation to the assumed learning outcomes [5-7,12,13].

The aim of work was to summarise the most important forms of cooperation between universities and employers, and to assess their influence on the civil engineering curriculum development.

2 METHODOLOGY

2.1 LEGAL CONDITIONS FOR THE HIGHER EDUCATION SYSTEM AND THE CURRICULA DESIGN

The legal regulations obligatory for higher education are subject to continuous changes resulting from the need to adapt them to the changing specifics of education, trends in the research fields, as well as to the progressive economic and socio-cultural transformations. The changes also result from the need to adapt the national legislation to the legal solutions implemented in the European Higher Education Area. In Poland, the Higher Education Act [1] is aimed at three strategic objectives: the creation of effective model of higher education management, the implementation of dynamic model of scientific careers, forming the model of efficiency-oriented education. The effectiveness of the higher education management model

involves the increase in institutional autonomy in forming their educational offer, and the ability to create the fields of study different from previously existing education standards and a list of fields of study. The obligation to define a field of study within the areas of education and scientific fields and disciplines, and to define appropriate learning outcomes has been introduced. The plans and programs of study and the level and profile of education should be adapted to appropriate learning outcomes. Learning outcomes for a field of study have to be consistent with the description of learning outcomes contained in the National Qualification Frameworks, which have become a compulsory basis for the creation of educational programs [5, 14].

The need to intensify the association of education with the requirements of socio-economic environment including labour market, for which the university educates its graduates, was also recognized. The participation of practitioners from organizations considered as potential employers of graduates, was incorporated into the teaching process, the design of learning outcomes and the implementation of study programs for practical profile. Moreover, the appropriateness of learning methods and usefulness of learning outcomes for the labour market are investigated by universities by tracking the careers of their graduates [10]. The current regulations have set new challenges for universities, aimed at improving the quality of education. For example, the organizational unit of the university can conduct first- or second-degree studies, if it implements an internal system of quality assurance.

Changes in Polish Law on Higher Education favour the adaptation of education system to European standards (Fig. 1). Changes focused on the following objectives: easier access to

higher education for mature people, within the concept of life-long learning, ensuring a better quality of education, considering the university autonomy in creation of curriculum, adaptation of university to the demographic decline effects. The proposed changes in regulations are a response to the growing demands of labour market and the need for more innovative approach to the education by involvement of people with practical experience to the teaching process, performance of interdisciplinary education using the latest technologies and formation the model of university cooperating with social, economic and cultural environment [4,7,9].

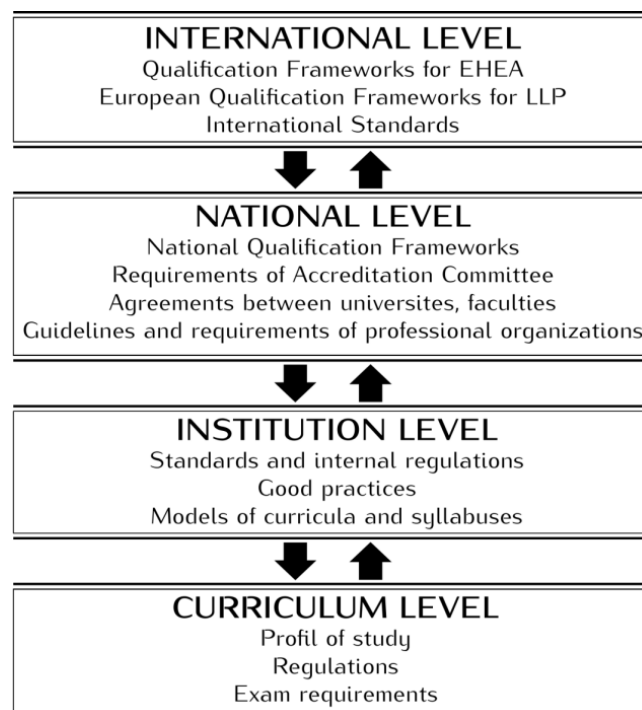


Fig. 1. Regulations determining curriculum design

The legislation clearly differentiates the requirements for practical and academic profiles of education, among others, obliging universities to increase, within the framework of

practical profile studies, the period of student internships or closer cooperation with experienced practitioners. This type of legal solutions should lead to a clear future division between the University for academic-oriented Scientific Research and gaining in-depth knowledge by the students, and vocational colleges developing practical skills and social skills of students. Additional statutory provisions allow for organizing the education alternately in the form of classes performed in universities and in the form of practice, completed at employer enterprise (dual studies), assuming the achievement of all learning outcomes set out in the curriculum for a selected field, level and profile of study.

Practical profile includes the modules for acquiring the practical skills and social competences. It is implemented with the assumption that more than half of the study program as defined in ECTS credits are the practical classes forming these skills, including those obtained during workshops conducted by practitioners with professional experience gained outside the university.

Academic profile includes the modules related to research conducted in the university, carried out with the assumption that more than half of the study program as defined in ECTS credits is the classes for in-depth knowledge acquisition. The solutions should limit the popular fields of study with many graduates whose qualifications do not meet the needs of the labour market, in universities that not guarantee a high level of education resulting from the lack of specialized academic staff. In addition, following the suggestions of employers in the current rules, the organizational units conducting the studies of practical profile are required to include at least three months of professional internship in the curriculum. Ministry of Science and Higher Education creates a database of about

employability of different universities and fields of study graduates. It is important for obtaining the objective and comparable data on the careers of professional graduates for the public, government and candidates. In addition, the universities conduct an analysis of graduates careers on their own, to match the offer of studies to the growing requirements of the labour market and the needs of employers, and to improve the quality of education offered to students.

2.2 ROLE OF EMPLOYERS IN EDUCATIONAL OFFER DEVELOPMENT

The latest amendments to the Law on Higher Education strengthened the role and importance of cooperation between the universities and socio-economic environment. The idea of curriculum based on learning outcomes should facilitate cooperation of universities with external stakeholders (e.g. employers, representatives of professional organizations) in the process of educational offer development. The share of external stakeholders in the formulation, implementation and correction of the development strategy of university and the policy of education quality, should cover the following aspects [10]:

- Scope and extent of the university cooperation with the institutions operating in its social, economic and cultural environment, in connection with the needs arising from the implementation of strategic objectives concerning teaching, research and development.
- Impact of cooperation on education process, considering the achievement of intended learning outcomes by graduate students and postgraduate students.

- Curricula of postgraduate studies and their implementation in conjunction with the learning outcomes providing entitlement to practice the profession, or new skills needed in the labour market, or updating and extending the knowledge, or the development of intellectual abilities in the system of life-long learning.
- Ways of identifying the needs of social, economic or cultural environment, in particular the needs of labour market, assessment of curriculum and learning outcomes together with the methods of verification, selection of program content, educational methods, the conditions for the practical professional training.
- Assessment of the university cooperation with socio-economic environment in the educational process - especially in determining and verifying the learning outcomes.
- Evaluation of teaching staff in relation to achieving the intended learning outcomes, according to the needs of employers and the labour market (e.g. the scope and relevance of professional experience gained outside the university, and their relevance to the objective of the program and the intended learning outcomes, as well as the teaching methods).
- Evaluation of the support provided to students in the process of entering the labour market (Career Office offer, cooperation with employers' organizations and labour market institutions, commitment to additional forms of gaining skills and competences by students).

At the beginning of National Qualification Frameworks implementation process, the participation of employers in curriculum design was symbolic. It was the result of lack of interest in the educational process or formulation the requirement for graduates for very specific skills

needed for a given position in the company. It is easy to understand, because many companies on the labour market face problems of hiring suitable personnel in jobs that are necessary for their proper functioning and development.

The particular factors influencing the curriculum design are simply mentioned in Fig. 2.

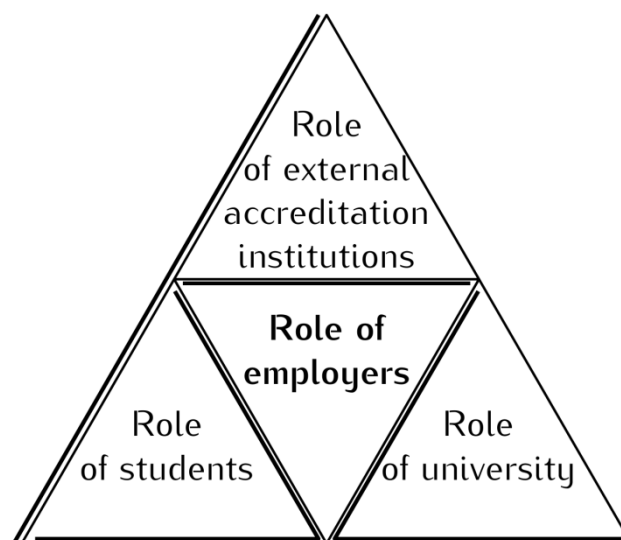


Fig. 2. Main factors influencing the curriculum design

The current question is "How to form the profile of the graduate meeting the needs of the labour market and the expectations of employers"? The employers usually are not familiar with the language of learning outcomes, thus the development of dictionary of market competencies is proposed in order to facilitate the communication between universities and business.

2.3 EXPECTATIONS OF EMPLOYERS FOR GRADUATES OF CIVIL ENGINEERING

The employers expect graduates to have a high level of competence that are a synthesis of theoretical knowledge, practical skills and personal features [8,15]. In their opinion, the

role of the education system is to prepare graduates practically for the profession and to provide them with a wide range of professional skills. Most frequently mentioned weakness of university graduates is the lack of experience and practical skills. According to representatives of employers, in the current system students are educated "very narrowly," whereas it is necessary to develop the ability of analytical thinking, ability to establish contacts, to create a harmonious cooperation, a sense of responsibility etc. Education in the field of civil engineering enables the acquisition of the majority of competencies considered important and useful in the work, except for the professional experience. The opinions of the employers and graduates working in the acquired profession are similar.

According to reports of the Career Office [11], the question about the criteria taken into consideration when hiring new employees is particularly important from the point of view of young people entering the labour market. When selecting potential employees the recruiters take into account first of all: the knowledge of foreign languages, motivation to work (including mobility and availability) and a curricula of completed study. More than half of the recruiters (respondents) pay attention to the interpersonal skills of the candidates, particularly in communication and teamwork. These skills are often marginalized in both the educational process and by the candidates looking for work. However, according to the opinion of working graduates of Bialystok University of Technology, highly developed interpersonal skills were the most frequently reported factor that contributed to their employment.

The employers indicate a lot of gaps in the education program or inadequacy of program to their specific needs. Poor adaptation of

graduates to the labour market manifests primarily in the lack of ability to flexibly adjust the program to meet the needs of the local labour market, not enough practical classes and practice acquired in university, the lack of opportunities to acquire the professional certificates during study period, inefficient division of education process into first and second degree, insufficient share of courses typical or fundamental for civil engineering in whole curriculum of study.

According to the representatives of employers, the adaptation of new employee to work in an enterprise lasts from one month to up to three years. In the case of small and medium-sized companies such as Mark-Bud LLC (Poland), usually there is no position of a tutor. After the initial introduction into the company's operation and health and safety instruction, the trainees get to the building site or to pre-production department, or to the department preparing offers. At the building site the trainee is expected to be familiar with project documentation and to be able to check whether, for example, the reinforcement of the floor is made according to the project - diameters, spacing, thickness of concrete cover, etc. This ability can be quickly possessed during the placement. However, a greater problem occurs with the preparation of production and making offers, where the lack of trainee's basic knowledge in the field of analysis of alternative solutions for optimizing the investment costs causes the internship not to be very effective. This knowledge could be provided by a capital tutor, but as it was mentioned earlier, in small and medium-sized companies such a position usually does not exist, and the employees of these departments are focused on their duties, not on educating younger colleagues. The optimization of the structure design is such a complicated matter, that without knowledge of the basic rules, which

should be gained during the study period, it is difficult to understand it during a short internship. The basic knowledge and understanding the selection of structures, their design and cost counting in different variants are extremely important for the internship to be effective.

The employers seeking suitably qualified employees try to help universities in the process of educating civil engineers.

3 RESULTS. FORMS OF COOPERATION BETWEEN EMPLOYERS AND UNIVERSITIES.

3.1 REPRESENTATIVES OF EMPLOYERS IN THE PROCESS OF ACCREDITATION

Polish Accreditation Committee (PKA) is the only statutory body in Poland responsible for assessment of quality of education provided by higher education institutions. Strengthening the role and importance of cooperation between universities and the socio-economic environment gave the Polish Accreditation Commission new tasks related to the need to include employers in the processes of assessment of education quality. In particular, the assessment of the implementation of conditions specified in the regulations introduced in 2014 for study programs of practical profile, required the intensive practical cooperation of PKA with employers. According to the latest regulations, a member of the Polish Accreditation Committee may be a representative of the employers' organizations, without a PhD degree. This solution allows to directly involve people who are not academic teachers, but possess significant practical experience and current knowledge of the labour market needs, into the work of PKA.

The way of introducing employer representatives and the effectiveness of their participation in the internal quality assurance systems of education, are the main subjects of evaluation in the process of accreditation. The faculties very often have several diverse fields of study in their educational offers, and even with the best system of ensuring the quality of education the creation of the study curricula that will meet the needs of the labour market cannot be guaranteed without more direct involvement of employers in the processes of

curricula development, along with determination and verification of learning outcomes (eg. through direct participation in the teaching process or in the framework of student internships). In many universities subjected to the above-mentioned assessments of PKA, the processes are decentralized and they are the most effective, extending on the level of specific fields of study, and sometimes even on the level of specialty, where the level of external stakeholders involvement is often the most direct and measurable. In addition, the regulations concerning the programs of practical profile require a very large commitment of employers and practitioners on several levels (from the influence on the curriculum, thorough the teaching classes up to direct participation in the student internship), which makes only experts with a lot of practical experience capable of accurately assessing the university activity in this field [10].

3.2 DUAL STUDIES

One of the most effective forms of employers' participation in creating a curriculum is a dual study. The dual study is an innovative system of study, assuming the acquisition of academic knowledge and practical experience at the

same time. The study program includes the necessary theoretical knowledge acquired during lectures, classes and laboratories/workshops at the university, interconnected with periods of work in various positions in the company, within the frame of a contracted internship. Dual study is characterized by closely linking education with practical activity in the workplace. In this way the theoretical knowledge is immediately put into practice. In order to determine the course of study and professional practice the programme council is appointed in agreement with the professional organizations, which include representatives of the companies and institutions employing students. As a result of extensive discussions the best form of the course is determined. During studies, the student learns about the structure and expectations of employers towards their employees. Student working at the plant also prepares interim papers thematically related to his work, and at the end of education he solves a specific problem associated with the plant, in the form of a thesis. The supervisors of the thesis are an employee of the university and a professional representative designated by the employer (with the title of at least MA/MSc). At the end of studies the graduate automatically becomes a potential full-fledged company employee, whose employment does not require any additional training or implementing to the corporate structure. However, the creation of such studies is associated with overcoming multiple organizational and financial barriers by all participants of the project.

3.3 POST-GRADUATE STUDIES

Easier form of preparing graduates for the needs of labour market is conducting joint post-graduate studies by the university and the

particular employer or employers of a similar profile. The implementation of post-graduate studies is independent of the course of studies leading to the professional title (MA). Classes in the course of post-graduate studies are targeted at the specific needs of the labour market to supplement the knowledge and skills of graduates. The teachers are partially the university staff and partially - practitioners (employees of enterprise). The studies are designed for graduates of first-degree study and can be implemented during the second cycle of study.

3.4 COOPERATION AGREEMENTS

In the frame of bilateral agreement the university and enterprise declare their willingness to cooperate in the areas covered by their statutory activities, in all legally permissible forms. Usually the agreement concerns the cooperation for implementation of joint projects in a selected faculty of civil engineering, such as:

- Participation of enterprise representatives in Programme Council of faculty,
- Optional (extra) courses for students and teaching staff of faculty,
- Outdoor activities - technical trips to building sites ("meeting with reality"),
- Scientific cooperation (joint projects, publications, conferences, etc.),
- Implementation of practical PhD thesis,
- Implementation of BSc and MSc theses suggested by enterprise with the participation of two supervisors (one from university, other from enterprise),
- 6-month internships according to the curriculum of study particularly important for study programs with practical profile),

- Optional internships for gaining practical skills,
- Industrial internships for teaching staff of faculty (according to individual applications),
- Competitions announced by enterprise for thesis in the specified topic (subject indicated by the company),
- Cooperation with the students' scientific teams,

As well as in other areas established during mutual cooperation. Particular activities under the agreement usually depend on the needs of the enterprise.

3.5 JOB FAIRS, PRACTICES AND INTERNSHIP FAIRS

The job fairs as well as the practices and internship fairs are cyclic events organized by Career Office of the university [11]. The project aims to gather the most attractive employers and several thousands of young professionals entering the labour market in one place. The premise of the project is to help employers to find workers, trainees and apprentices, according to their needs for human resources. During the fairs, they have the possibility of direct contact with students and graduates. From the students' point of view, the fairs are an excellent opportunity for direct contact with the employers. They give them the opportunity to read the profile of the company and the rules of recruitment.

Traditionally, the training and workshops for students are offered during the fairs. For example, last year "Start a career within the Google Revolution" training was organized, where students learned about the latest online trends, learned about the possibilities of using the Internet to promote their activities, and

career prospects in the internet marketing. Another workshop concerned entrepreneurship and included issues relating to career management and promotion of proactive life. It also presented the information on the possibility of obtaining a grant to set up a business. Additionally, students could get advice from a career counselor on writing application documents.

3.6 SEMINARS AND TRAINING ORGANIZED BY THE PROFESSIONAL ASSOCIATIONS

The subjects of conferences and seminars organized by professional associations, and often also by individual employers are beyond the scope of typical curriculum of study. The topics often fill the gap in the typical university education, regarding the latest trends in the civil engineering, as well as the specific needs reported by employers, that should be incorporated into educational process of engineers.

Examples of seminar topics:

- "Efficient design" - analysis of calculation in search of reserves.
Efficient designing means the design which effect is optimizing the use of reinforcing steel, keeping the same cross section area of structural element. Efficient designing means the minimum consumption of reinforcing steel that provides requirements of safety and operation of structure. It is assumed in advance that all standard requirements are complied with, and in this aspect there cannot be any exceptions.
- "CICER CUM CAUL, or a bit of everything".
Some important issues of reinforced concrete structures, sometimes slipping designer's mind, which may result in

unintended consequences. These are e.g.: load, design of reinforcement subjected to fire, abnormal flexion of bending reinforcement, structure deflection and cracking - the method of calculation, comparative calculations, results, taking into account the history of load, etc.

- Optimization of solutions to steel structure design. The selected issues of stability of bar structures according to EN 1993-1-1; lateral buckling of beams according to PN-EN 1993-1-1; modeling the nodes susceptible according to PN-EN 1993-1-8 and the calculation of shell structures according to EN 1993-1-6.
- Fire safety in buildings: the discussion about recent issues in fire safety in civil engineering objects: a case study of a building meant for production and storage with the inclusion of the administrative office.

4 CONCLUSIONS

In current economic situation, it is difficult to talk about education corresponding to the needs of specific jobs, because new jobs are created at the interface between many existing specialties.

The graduates should be prepared not only to perform a specific profession, but they should be able to use their competences on the changing labour market. University graduates should therefore be characterized by employability. Therefore the possibility to set the special path of education in cooperation with employers should be recommended.

The participation of employers in the curriculum design and evaluation of its quality has increased since the representatives of

employers were included in the external evaluation committees.

The awareness of employers about their needs, and opportunities to influence the education program is growing constantly.

The enterprises are becoming increasingly active, and they offer universities various forms of cooperation in order to prepare graduates to enter the labour market.

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