In: Beiträge der 48. IGIP Konferenz zur Ingenieurpädagogik im September 2019 in Bangkok, Thailand

The Needs-Oriented Approach of the Dresden School of Engineering Pedagogy and Education

Diego Gormaz-Lobos
Universidad de Talca, Chile
CIEI - IGIP Zentrum Universidad de Talca Chile
Diego_Osvaldo.Gormaz_Lobos@tu-dresden.de

Claudia Galarce-Miranda
Universidad de Talca, Chile
CIEI - IGIP Zentrum Universidad de Talca Chile
Claudia.Galarce_Miranda@tu-dresden.de

Hanno Hortsch
IGIP, International Society for Engineering Pedagogy
Technische Universität Dresden, Dresden, Germany
hanno.hortsch@tu-dresden.de

Steffen Kersten
Technische Universität Dresden, Dresden, Germany
Steffen.kersten@tu-dresden.de

Abstract—This paper presents different aspects about the Needs-Oriented Approach on Engineering Pedagogy and Education developed since 1951 at the Technische Universität Dresden (Germany). Prof. Hans Lohmann founded in 1951 the Engineering Pedagogy Institute at the TU Dresden in his quest to systematize and to professionalize at an institutional level the teaching and research in engineering. Engineering Pedagogy is an interdisciplinary scientific subject that collect the „needs“ and „demands“ of: engineering and technical sciences, pedagogy and didactic and the education system in itself (see Lohmann, 1954; Melezinek,1999). Lohmann's work is continued at the present at the Institute for Vocational Education at TU Dresden, in charge of Prof. Hanno Hortsch (currently President of IGIP), who leaded many research projects in engineering education in Germany and another countries. Kersten (2015) proposes a scheme that describes the factors that influence and condition the Engineering Education: (i) the economic sector, (ii) engineering sciences, (iii) society, and (iv) the student (see Kersten, Simmert & Gormaz, 2015). The results of two surveys show the (1)„needs“ of academic training related to the different pedagogical aspects, and (2) „needs“ for different knowledge, skills and technological tools for the teaching in engineering careers in relation to current and future industrial requirements. A Needs-Oriented Engineering Pedagogy seeks to establish a teaching and learning process that is better focused on the context where it develops.

Keywords— Engineering Pedagogy, Needs-Oriented Engineering Pedagogy, Needs-Oriented Engineering Education, Dresden School of Engineering Pedagogy and Education

1 A short history of the Dresden School of Engineering Pedagogy

With the foundation of the Institute for Engineering Pedagogy at the Technische Universtität Dresden (TU Dresden) in 1951, Lohmann laid the starting point for the tradition of the Dresden School of Engineering Education and Pedagogy. Through his paradigm of technology and its teaching, Lohmann influenced the engineering pedagogy and research at the TU Dresden in the following decades and is still valid for the design of teaching and learning processes in academic Engineering Education.

The starting point of Lohmann's scientific reflections was the connection between the structure of a science and its teaching: every scientific teaching requires first the analysis of the corresponding science. Engineering science, which seeks and gains knowledge in and from the state of the art (see Lohmann, 1954), requires therefore an analysis of technology. The concept of technology itself was defined by its function of "transforming the natural world" (602). Decisive for the connection of specialized science and educational science are the methodology of the subject science and the methodic of its teaching. While methodology refers exclusively to ways of finding knowledge in the field of science, methodic encompasses the paths of knowledge in which the teacher leads his students from the unknown to the known (see Lohmann, 1954). From the investigation of theory and practice of technology Lohmann derives conclusions for the design of the teaching of technology and technics. This was done both for the "internal", methodical design (goals, structure of contents, methods, and procedures for instance), as well as for the "external", organizational design of this teaching (for example, the choice of students based on their suitability for the job description or the trainings coordination based on requirements of the economy) (see Hortsch & Reese, 2012).

In 1963 Prof. Franz Lichtenecker took over the management of the Institute for Engineering Pedagogy with new scientific reflections. In cooperation with Hering published in 1963 " Lösungsvarianten zum Lehrstoff-Zeit-Problem und ihre Ordnung“ (Solution Variants on the Contents-Time-Problem and Its Order) a text that presented new perspectives about didactic questions on Engineering Education. The solution variants to the contents-time-problem offers possibilities to resolve permanent dilemma of increasing amount of knowledge and limited training time. Through very concrete scientific and technical examples will try to find solutions for this problem. This solutions are derived on a high level of abstraction and thus universal applicability. The solution variants had two main focuses (see Hortsch & Reese, 2012):

- the “contents restriction” (for example by modeling or didactic simplifications) and
- the “qualification for/to a” contents manage (for example developing skills or using algorithms)

Through Lichteneker's administration other colleagues at the TU Dresden were able to continue researching and complementing key didactic elements of Engineering Education. In particular, the basic of didactic categories (e.g. goal, content, method), supporting organization forms (e.g. lecture and exercise, Wenzel, 1983), laboratory internship (Malek, 1980), as well as subject-specific Study processes (Geiger, Klose, Lichtenecker, Wenzel, 1975) (see Hortsch & Reese, 2012).

Since 1986 Prof. Lehmann directed the Dresden School of Engineering Pedagogy with focus at the research on the entire process of training and further education of engineers, and thus on the design of curricula for entire engineers degree programs at discipline and specializations level (see Hortsch & Reese, 2012).

The political change in East Germany had different effects and changes at TU Dresden. Prof. Eberhard Wenzel leaded since 1992 the School of Engineering Pedagogy at the Institute for Vocational Education. His scientific endeavors are aimed at researching the term "university-didactic thinking". Wenzel defines "university didactics" as a special kind of didactic. In this way, he makes term explications in such a way that the basic concepts of the didactics of vocational education and training are transferred to the teaching and learning situations in the higher education sector. One of his merits is for example the transfer of the “goal” categories to the field of academic teaching. In this connection were specified the functions of classical organizational forms of academic teaching such as lecture, seminar, proseminar and exercise (see Hortsch & Reese, 2012). Another important goal for Prof. Wenzel was maintaining or even expanding the traditions of engineering pedagogical teaching in national and international context. A further step in engineering pedagogical research was presented by the 1st Engineering Pedagogy Colloquium organized at the TU Dresden (February 2000) by Prof. Binger (Faculty of Mechanical Engineering) and Prof. Hortsch (Faculty of Education). With participations of guests of all universities of the Free State of Saxony, the International Society of Engineering Education (IGIP), Siemens AG and guests from other universities was an important step to fix and present scientific results on Engineering Education.

During the period of the professorship for Engineering Pedagogy by Prof. Wenzel were offered two-semester courses focused on "University didactics". They aimed to establish a “didactic minimum qualification" on the academic staff and were positively evaluated by the academics at the TU Dresden (see Hortsch & Reese, 2012). Since the retirement of Prof. Wenzel, the work, tradition, and innovation of the Dresden School of Engineering Pedagogy have been continued by the Chair of Didactics of Vocational Learning, under the leadership of Prof. Hortsch. The majority of the courses with matters in Engineering Pedagogy and didactics are currently taught by Dr. Kersten, Chair of Didactics of Vocational Education at the TU Dresden.

In a synthesis of the contributions of the Dresden School of Engineering Pedagogy and Education over the years can be emphasized as main achievements:

- The formation of the methodological basis for the synthesis of engineering sciences and pedagogy as the interacting factors of qualitative change in the training of specialists in technical disciplines;
- Extending the tasks of engineering education in the form of the transition from the analysis of technical sciences and their specifics teaching methodologies;
- The introduction of engineering into the problem area of the economy, global socio-anthropological and psychological questions and the relationships between engineering subject and teaching methods;
- The establishment of the methodological basis for the additional pedagogical training of graduate engineers at technical universities, as well as the introduction of the first internship in the engineering pedagogic training at the Technical University of Dresden (in 1958) with the subsequent acquisition of the certificate "Additional Examination in Pedagogy”.

From the 1950s were founded and developed three "schools of Engineering Pedagogy" in Europe: the Dresden, the Prague and the Klagenfurt school of Engineering Pedagogy (see Rüütmann, & Kipper, 2016). It is important to mention that the Schools for Engineering Education in Austria and Czechoslovakia were founded based on the theoretical and practical achievements of the Dresden´s workgroup. The experiences of these three European schools of engineering pedagogy became the theoretical basis for the founding of IGIP (International Society of Engineering Pedagogy) in 1972 in Klagenfurt, Austria. The main initiatives in the field of engineering pedagogy of the Dresden School, in cooperation with representants of the Prague and the Klagenfurt schools, have significantly influenced the formation of the specific characteristics of the international movement in this area, which is concretized by the worldwide activities of IGIP and IFEES (International Federation of Engineering Education Societies) and other organizations.

2 Needs-Oriented Engineering Pedagogy

2.1 The approach of the Dresden School on needs-oriented Engineering Pedagogy

At the development of the Dresden School of Engineering Pedagogy can be recognized different contributions. On the one hand could be clarified that Engineering Pedagogy, in a traditional view of higher education didactics, is a target group oriented design of teaching and learning processes in academic Engineering Education. Moreover, Engineering Education at TU Dresden is also aimed at future engineers, for instance at the design of social-communicative processes in the leadership of engineers. From this point of view, in the last 20 years, have been developed different courses that prepare future engineers for their tasks in the areas of employee management, team development, conflict management, problem-solving processes as well as the design of informative, explanatory and argumentative communication processes. In this way, it is possible to recognize research processes for the Engineering Education and Pedagogy that are geared to different demands and, at the same time, needs to be covered for different factors.

Kersten (2015) proposes a differentiation between four different factors that influence and condition (demands) the Engineering Education: (i) the economic and production sectors of a country, (ii) engineering sciences, (iii) society and culture of the country and (iv) the individuals who study engineering (see Kersten, Simmert & Gormaz, 2015):

- **Economy.** The labour market is a window that shows the demands of production and services. The labour market of a region has a strong relationship with the structure of the economy. Concerning this, the relation between industry, agriculture, and service has the same importance than the development of different sectors in industry, trade, and service. These factors determine decisive the demand for qualified engineers and the characteristic of their qualifications, for the present and the future. The specific demands on the employees concerning their required qualifications, abilities, skills, knowledge and experiences are

determined by the character of professional work in the structures of production and service.

- **Society.** Engineering Education and Higher Education is part of a social and political system. In so far, Engineering Education has to meet the demands and needs of the society. These demands are determined by political systems, cultural developments, the history and the development of the society, ideologies, religions and concluding from it, by values, norms, views and attitudes. The term "demand-orientation" contains accordingly also the social demands. The individual development of social adjusted values, norms, views and attitudes is the socialization part of the Engineering Education.
- **Science.** Production processes and professional labor are influenced by the development of technique and technology and thus by the development of related sciences. Technological advances and the new knowledge generated are constantly observed, as well as the optimization of systems and production processes based on scientific knowledge that sometimes must be reformulated. All this generates permanent demands and needs to update knowledge the verification and new uses of them.
- **Student.** The design of teaching and learning processes in Engineering Education has to correspond with the individual characteristics of the personality of learners: pre-conditions of the learners, age-specific psychological characteristics, individual values, norms, attitudes and needs of learners.

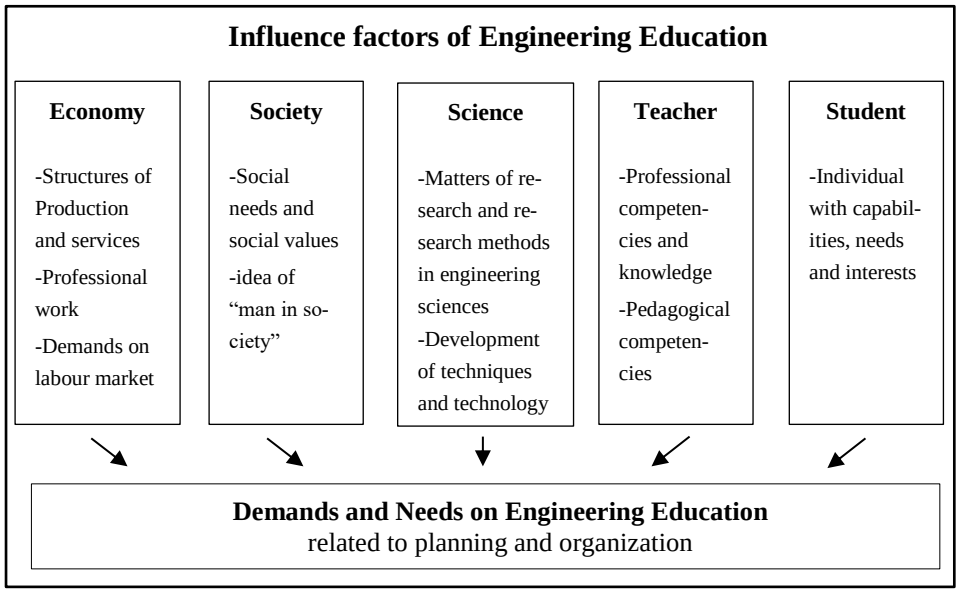

Fig. 1. Influence factors of Engineering Education

To these factors must be added a key-factor to the learning process in engineering: the **teacher**. Since Lohmann (1951) to the actually has been looked with special emphasis the domain of the academic staff on the specific knowledge of each area of the engineering sciences but also of the knowledge, methods and tools for its teaching. Figure 1 shows a systematization of the five factors that generate the demands and needs in the Engineering Education.

The university didactic perspective in Engineering Pedagogy works for the qualification on academic teaching of the staff in the engineering sciences. In addition to demand-oriented further education courses on Engineering Pedagogy and didactic fields of activity (for example laboratory didactics, control and evaluation of study results and intercultural communication), has been developed a range of courses for university teachers that builds on the requirements of designing teaching and learning processes in the field of Engineering Pedagogy prepared specially for the academic Engineering Education.

2.2 Some projects on Needs-Oriented Engineering Pedagogy related to the Dresden school of Engineering Pedagogy

E-Didactic project

For the project E-Didactic a team headed by Prof. Hortsch and Dr. Kersten (Chair of Didactics of Vocational Learning, TU Dresden), developed a needs-oriented training program in 2010 to academic staff for engineering faculties of Saxony. This program was composed of 4 module areas with a total of 12 study modules, with a scope of 20 Credits Points. In the first stage of the project, a research of pedagogical and didactic needs in the engineering faculties was developed. For this purpose, were implemented individual surveys, a focus group with the academic staff and class observations. The main results obtained in this research regarding needs and requirements were related to: (i) use of special forms of teaching and learning in academic engineering education, (ii) specific problems of designing learning control processes, (iii) development of a positive feedback culture, (iv) structuring of evaluation of courses, (v) didactic basics of planning, implementation, and analysis of academic teaching, (vi) design, selection, and use of didactic media, (vii) design of communicative processes in academic teaching among others (see Köhler, Umlauft, Kersten & Simmert, 2013).

Goals and contents of the study program were determined together with the engineering science staff of the University of Applied Sciences Zittau / Görlitz in a needs analysis and led to the following module structure (see Table 1). The study program is accredited by the International Monitoring Committee of the International Society for Engineering Pedagogy (IGIP) as a study course for the certification INTERNATIONAL ENGINEERING EDUCATOR "ING.PAED.IGIP", and certified by the board of the Engineering Pedagogy Science Society (IPW) as a degree program for the ENGINEER EDUCATOR (IPW).

Table .1. Modules overview of the Training Program "ING.PAED.IGIP"

Training Program **INTERNATIONAL ENGINEERING EDUCATOR "ING.PAED.IGIP"**					
I. Engineering didactics fundamentals					
Units	**Qualification goals**	**F* A ****	**I* W ****	**W* P ****	**C* P**
I.1. Design of teaching- learning processes in engineering sciences	The students are able to design teaching and learning processes in the engineering education according to target groups based on a pedagogical scientific ways.	30	15		1,5
I.2. Didactic media for teaching in engineering	The students have knowledge of the conceptualization of didactical media, the functions of didactic media in teaching and learning processes, the didactical media action´s areas and basic design approaches.	18	45	27	3
I.3. Communication	The students are able to conduct, purposefully and appropriately, communicative processes in their teaching activities on the basis of pedagogical scientific ways and in consideration of personality characteristics of the communication partners.	22	46	22	3
I.4. Control and Evaluation of the learning outcomes in Engineering Education	The students are able to design control and evaluation processes of learning outcomes (qualifications, competencies) on the basis of scientific findings.	30	40	20	3
II. Forms of structuring the teaching-learning processes in university contexts					
Units	**Qualification´s goal**	**F A**	**I W**	**WP**	**C P**
II.5. Lectures (theoretical courses)	The students are able to plan, perform and follow up the lecture / seminar / consultation courses according to the desired qualification goals.	20	15	10	1,5
II.6. Laboratory practical training/ self-study	The students are able to design teaching and learning processes in laboratory work in exercises as well as in self-study on the basis of scientific findings purposeful.	15	20	10	1,5
II.7. Engineering internships, written reports, research colloquium	The students are able to plan, carry out and follow up on the academic course types Engineering Practical / Documentation / Research Colloquium according to the desired qualification objectives.	18	15	12	1,5
III. Determining objectives and contents of engineering studies					
Units	**Qualification´s goal**	**F A**	**I W**	**WP**	**C P**
III.8. Determination of the study programme objectives	The students are able to determine independently the course and study module objectives for engineering courses in their engineering specialization.	18	15	12	1,5
III.9. Determination of the engineering study programme contents	The students are able independently to derive, structure and present the corresponding study program or study module content from the study program objectives.	21	13	11	1,5
IV. Practical module					
Units	**Qualification´s goal**	**F A**	**I W**	**W P**	**C P**

IV.10. Case discussion	The students are able independently to apply schemata for documenting, reflecting and evaluating exemplary teaching events.	4,5	4,5	6	0,5
IV.11. Classes observation	The students are able independently a class to document, analyze, evaluate and reflect in order to achieve a continuous professionalization of their teaching activities.	12	8	10	1
IV.12 Final Colloquium	The students are able independently to plan a final colloquim with the help of a planning scheme, then carry it out and finally evaluate it.	3		12	0,5

* FA: face-to-face activities; IW: independent work; PW: work on project/tests; CP: credits points

** in hours

PEDING and STING projects

Continuing with the objectives proposed by Prof. Wenzel (internationalization of the Engineering Pedagogy), the Chair of Didactics of Vocational Learning of the TU Dresden headed by Prof. Hortsch established since 90´s work proposals in Engineering Pedagogy and Education with various universities and organizations in Asia (in Vietnam and China for example) and other countries.

Since 2014 works the TU Dresden in cooperation with Chilean universities in two projects with the objective of strengthening Engineering Education.

The aim of the first project "Engineering Didactics at Chilean Universities" (PEDING-Project) is the development and testing of training modules for teaching qualifications of teaching staff in academic Engineering Education based in the IGIP Curriculum offered for the TU Dresden. In the first stage of this project, Gormaz (2014) systematized and operationalized in clusters categories and indicators, which later were used in the recollection instrument on teaching needs of the engineering faculty of the three Chilean universities: Universidad Autónoma de Chile (UA), Universidad de Magallanes (UMAG) and Universidad de Talca (UTAL) (see Gormaz & Kersten, 2014). The basis for this work was an analytical adaptation of the instruments and research results of the E-Didactic project about the training requirements of lecturers at engineering faculties from Saxony (Germany) (see Köhler, Umlauft, Kersten & Simmert, 2013), In general the instrument and indicators seek to obtain information about: (i) characteristics of lecturers (years of experience, subject matter, etc.), (ii) experience and needs related to engineering didactic fundamentals, (iii) requirements for the structuration of Teaching - Learning forms in a university context, and the setting of objectives and contents of an engineering degree, and, (iv) identification of strengths and weaknesses, together with the conditions to enroll in a training course. The results of this research about the needs in Engineering Education were used in the development of the training modules and created the bases of a training course offered in 2018 in Chile, modelled from the learning module structure according to the IGIP (International Society for Engineering Education) standards and the TU Dresden, Faculty of Education. The trainings course was offered in blended learning modality and has a participation of more than 50 academics from different regions of Chile.

The aim of the second Project "Strengthening engineering training at Chilean universities through practice partnerships" (STING-Project) is the development and testing of training modules for students (either for electrical or mechanical engineers) and teaching qualifications of teaching staff in academic Engineering Education based in demands

and employment- requirements of German and Chilean companies. For this reason was developed a questionnaire by the TU Dresden and the USACH as part of a stage of information gathering to obtain the strategic positioning and future development of the participant enterprises. The goal of the application of this questionnaire is to know the opinion of strategic staff of the companies regarding the actually needs and the projected future scenario for engineers, and the type of "technology transferences" between university-company. The results of this survey were used in the development of two training modules for students at the USACH.

Some results obtained with the surveys applied to the academics of three Faculties of Engineering and the strategic Staff (experts) of seven companies are presented below (see Hortsch, Gormaz-Lobos, Galarce-Miranda & Kersten, 2019):

- **Perception and needs in Engineering Pedagogy and Education at the universities**

  Regarding the need for different skills and pedagogical tools for university teaching in engineering careers, was asked "How necessary do you consider the following aspects of Engineering Pedagogy in relation to your teaching experience?" For this section, 28 aspects were considered based on criteria and results of the E-Didactic project (see Gormaz & Kersten, 2014), being the most relevant those related to the evaluation methods, among which stand out with more than 95% of the preferences aspects such as: "Evaluation and assessment of achieved learning" and "Knowledge about design for effective measurement of achieved learning". Then with more than 87% of the preferences are "Structuring of teaching-learning processes in the scientific training of engineers", "Use of didactic resources and information and communication technologies" (ICTs). The results by university do not suffer major modifications. Some discussed aspects present a great difference between the institutions. In 3 aspects, the UA has preferences above 80%, while UMAG and UTAL are under 62%: "Recognition and resolution of conflicts within the classroom", "Planning of activities for individual study" and "Analysis of the personal scope of engineering in Chile". Another aspect where there is a marked difference is "Knowledge about strategies to support professional practices and independent research activities" where the UA and UMAG have preferences over 85% while UTAL does not reach 57%. These differences may be due to the different programs given at each University, as well as to the institutional and social context and to the training given to the participants
- **Perception and needs in Engineering Pedagogy and Education at the companies**

  Regarding the need for different knowledge, skills and technological tools for the teaching in engineering careers, the strategic Staff (experts) of seven companies answered to the question "What are the most important competences for engineers?" The results are presented in Figure 2 and show many different competences like "leadership", "team working" and "autonomy" are the most valuable skills for companies, whit 87.5%, 87.5% and 75% of the preferences, respectively. Another question was oriented to the importance of innovation and research. The companies were asked "How relevant is for you that engineers students have experience in innovation and research project through their university time?". The 37.5% gave 5 out of 5 points (most relevant) to these

characteristics, while a 37.5% gave out of 4 points and 25% gave 3 out of 3 points. Therefore, the tendency to appreciate the experience of students in innovation and research projects is noticeable. In relation to needs about technical software for electrical and mechanical engineers, the most popular option was Microsoft Office, which includes Excel, Power-Point, Word, and Outlook, with five preferences (93%). Then, AutoCAD was the second option (86%), and finally "Project" comes in the third place.

Figure 2 systematized the results of the two surveys on needs in Engineering Pedagogy and Education in Chile.

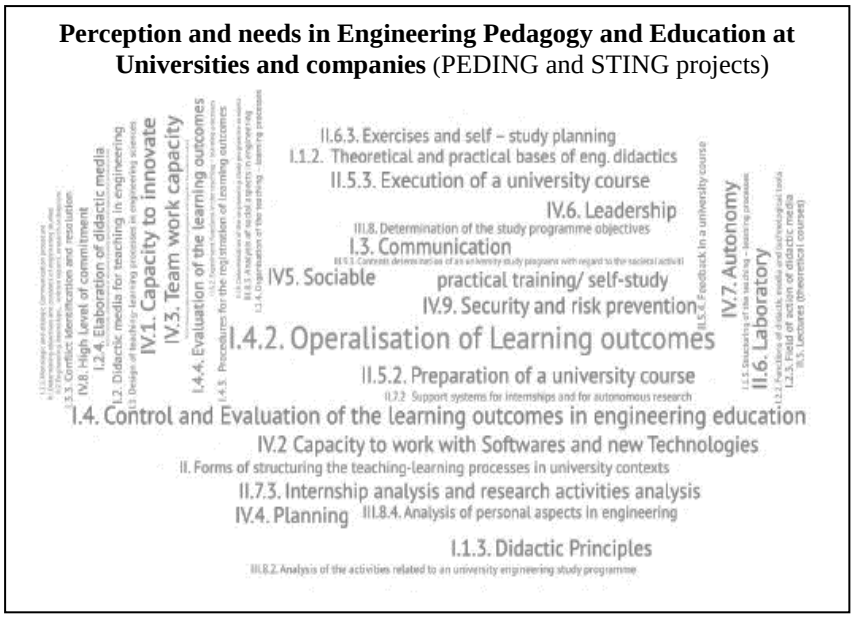

Fig. 2. Needs in Engineering Pedagogy and Education in Chile

3 Conclusions

The contributions and impacts of the scientific developments generated at the Dresden School of Engineering Pedagogy over the years are considerably. The conceptions, methodologies and tools developed by Lohmann, Lichtenecker, Lehmann, Wenzel, Hortsch and Kersten among others have been fundamental to understand and generate better teaching and learning processes inside the engineering faculty of the TU Dresden and other faculties of the world. In this article we have focused specifically on the need oriented perspective of the Engineering Pedagogy that as mentioned above appeals to collect needs of five "actors" (economy, society, science, university teachers and students) to planning, develop and evaluate a better engineering learning processes.

From the results obtained from the "needs" surveys it is possible to conclude, that the academic communities of the studied engineering faculties, tend to converge on the pedagogical capacities that are required to train the future engineers. German and Chilean

academics from different engineering faculties are willing to train and incorporate systematic knowledge and skills, based on the tools of Engineering Pedagogy, to enhance the skills they already possess and thus improve the strategies and methods of teaching directed to its students. From the results of the survey of the E-Didactic and PEDING project were identified many different needs in the field of engineering didactics: (i) "Evaluation and assessment of the students' learning achievements", (ii) "Organization of teaching and learning processes for the scientific formation of engineers", (iii) "Theoretical and practical knowledge about the didactics for the teaching and learning process in engineering", (iv) "Knowledge about how to design effective measurements of the learning accomplishments", and (v) "Use of didactic resources and of information and communication technologies (ICTs)".

As shown on the results of the STING survey, the companies identified many needs for the education process of engineers in relation to current and future industrial requirements. In general, the main needs in Engineering Education for the companies were: (i) to increase team working during student's careers, (ii) to renew high-tech equipment to improve laboratories and thesis projects, (iii) to increase the link company-university through the development of joint projects, (iv) to incorporate new technologies into classical Engineering Education, and (v) to promote applied research. Additionally were identified for example that: (vi) engineers must have the analytic capability, and they must be able to learn on their own, (vii) the communication company-client is fundamental and must be considered in Engineering Education, (viii) team working and leadership are fundamental either for junior or senior engineers, and (ix) because of the characteristics of Chile, engineers must know how mining industry works and the security regulations.

A need oriented Engineering Pedagogy seeks to establish a teaching and learning process that is better focused on the context where it develops. This process can start meeting needs of the labor market, the society, or another "factors": but everything should be oriented to facilitate the development of skills and acquisition of knowledge by the future engineers, based on appropriate scientific knowledge with the appropriate pedagogical methods in the context of the 21st century.

4 References

1. Creswell, John, W. (2003). Research design: Qualitative, quantitative, and mixed method approaches. Lincoln Nebraska: Sage Publications University of Nebraska, 217-219.
2. Geiger, K. & Klose, J. & Lichtenecker, F. & Wenzel, E. (1975). Die didaktische Projektierung lehrfachgebundener Studienprozesse als Aufgabe und als Tätigkeit des Fachschullehrers. Studien zur Hochschulentwicklung, Berlin.
3. Gormaz, D., & Kersten, S. (2014). Zur Analyse der ingenieurpädagogischen Weiterbildungsbedarfe von Lehrende. In: Projektbericht DAAD 2014. TU Dresden, Institut für Berufspädagogik, Dresden.
4. Heidegger, G., & Rauner, F. (1991). Berufe 2000: Berufliche Bildung für die industrielle Produktion der Zukunft. Düsseldorf., 20.
5. Hortsch H. & Gormaz-Lobos D. & Galarce-Miranda C. & Kersten S. (2019). Needs-Oriented Engineering Pedagogy - Research Projects in Chilean Universities. In: Auer M. & Tsiatsos T. (Eds) (2019). The Challenges of the Digital Transformation in Education. ICL 2018. Advances in Intelligent Systems and Computing, vol 917. Springer, Cham, 741-753.

6. Hortsch, H. & Reese, U. (2012). Historische Aspekte Ingenieurpädagogischer Lehre und Forschung an der TU Dresden. In: Hortsch, H.& Kersten, S. & Köhler, M.: Renaissance der Ingenieurpädagogik – Entwicklungslinien in Europäischen Raum. Referate der 6. IGIP Regionaltagung, 9 – 25.
7. Kersten,S. & Simmert, H. & Gormaz, D. (2015). Engineering Pedagogy at Universities in Chile - A Research and Further Education Project of TU Dresden and Universidad Autónoma de Chile. In: Expanding Learning Scenarios. EDEN Conference Barcelona 2015.
8. Köhler, M. & Umlauft, T. & Kersten, S. & Simmert, H. (2013). Projekt Ingenieurdidaktik an Sächsischen Hochschulen - E-didaktik. Projektabschlussbericht. Dresdner Beiträge zur Berufspädagogik, 33. Dresden.
9. Lehmann, G. & Malek, R. (1991). Entwicklung der Ingenieurpädagogik an der TU Dresden 1951 bis 1991. TU Dresden, Dresden.
10. Lohmann, H. (1954). Die Technik und ihre Lehre. Ein Forschungsteilprogramm für eine wissenschaftliche Ingenieurpädagogik. Wissenschaftliche Zeitschriften der TU Dresden, 602-621.
11. Malek, R. (1980). Die Gestaltung des Laborpraktikums in der sozialistischen Ingenieurausbildung aus hochschuldidaktischer Sicht. Wissenschaftliche Beiträge Technische Universität Dresden, 30. Dresden.
12. Melezinek, A. (1999). Ingenieurpädagogik – Praxis der Vermittlung technischen Wissens, Springer-Verlag, Wien New York.
13. Neuman, W. (2011). Social Research Methods: Qualitative and Quantitative Approaches. München [u.a.]. Pearson.
14. Rüütmann, T. & Kipper, H. (2016). Klagenfurt School of Engineering Pedagogy by Adolf Melezinek as the Basis of Teaching Engineering. In: International Journal of Engineering Pedagogy, Volume 6, Issue 3, 10-18.
15. Wolffgramm, H. (1994). Technische Systeme und Allgemeine Technologie. Bad Salzdetfurth.