DT4VET

ERASMUS KA-202 Strategic Partnerships for vocational education and training

DT4VET: Educating Designerly Thinkers for Vocational Education and Training: Design Thinking Tool for Educators

PROJECT REPORT

O2 – What do IVET Need?

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1 INTRODUCTION

The education and training institutions seem heavy, slow, and stagnant from the outside. However, they are the institutions that are most rapidly affected by many concepts that affect the world. Social, economic, environmental, and human changes and transformations created by globalization, technology, communication, and information diffusion directly impact learning environments. Especially higher education institutions and vocational education institutions should be dynamic and adaptable, as they train the workforce in this fast-paced environment, and their education systems should be prepared for jobs that have not yet been created, technologies that have not yet been invented, and social problems that have not yet been anticipated. They need to experiment with new formats and strategies for learning and teaching to provide appropriate, effective, and high-quality learning experiences in the future.

The DT4VET Project has a unique significance in Europe, where the concept of vocational education originated. As is well-known, practically everywhere in Europe and for centuries following the founding of guilds, the job and education of artisans were very similar. Guilds were organizations where artisans gathered to establish their norms and defend their rights. They mostly served political and economic functions. Concurrently, the Guild system established the guidelines for vocational training. Even with the emergence of modern education throughout Europe and later, the same hierarchical understanding may be observed. It is recognized that the apprentice, journeyman, and master system is approved and that there are interlevel qualification requirements and certifications for each level. Each trade or craft (modern professional disciplines) had its community acceptance requirements (qualifications, skills, etc.). (professional associations, etc.). Journeymen went from place to place to learn from masters in other countries and improve their skills. This led to professional qualifications being recognized in other countries. Thus, an early type of occupational mobility emerged in Europe, followed by a proliferation of vocational training models. The interaction between the industrial society management model and the school consists of a myriad of school-related activities. Numerous 'modern' education systems supplanted the craft/trade-based vocational training techniques that had been in existence for centuries in Europe as a result of the industrialization process. In this sense, it is feasible to state that vocational training is associated with the acquisition of practical skills for/in a particular "area" of work.

There are studies in the literature on vocational education that suggest it is an approach for those who believe it is unsuitable for meeting the needs of the industry, increasing industry productivity, educating individuals with a sense of mastery "to another form of value," acquiring technical skills and knowledge for professional competence, or academic education. The dictionary definition of professional development is "the development of competence or knowledge in one's career; it is the process of learning the skills necessary to improve job performance." This definition recognizes that professional development is frequently provided by or on behalf of an organization and must have a direct connection to the employee's

work position and the organization's goals and objectives. The primary objective of vocational education is the enhancement of work proficiency. Vocational education equips individuals with (1) daily working procedures, (2) the ability to make decisions and take initiative, (3) numeracy and digital literacy, (4) a respectful attitude toward work, (5) multidimensional thinking, economics, and it is expected to provide skills such as social awareness, (6) curiosity, desire, and a flexible approach to continuous improvement.

The provision of specialized training is the primary result of vocational education. The definition of expertise is the possession and application of a high level of knowledge and competence in a particular area of study. For this, it has always been vital to share and apply expertise, and the capacity for creative thought is at least as essential as knowing. In the past, vocational education focused on developing general competencies, but in more recent years, it has been reframed as the development of 21st-century skills applicable to a variety of different occupations.

The primary objective of the DT4VET project is to clarify the role of Design Thinking in VET Education, first and foremost by developing a DT4VET Toolkit for Vocational and Technical High School Educators and all educators, and by identifying new teaching/learning approaches that may apply to online education. The key beneficiaries of this project are educators who wish to update the education system and teaching/learning approaches and advance. Many in education and curriculum are unfamiliar with these rising education trends or Design Thinking, but they recognize the need for a change in education and training. Due to the nature of the Design Thinking process, toolkit users are not required to be designers, nor do the trainers interviewed for this project have a formal design education. DT is characterized by user empathy, innovative thinking, and a human-centered approach. Educators are intended to expand their learning experiences, develop their competences, and then communicate this with students through lesson teaching strategies by utilizing the set created for this project. Following this plan, the outcomes of this project will offer educators essential support.

2   What does IVET need?

2.1   Why IVET?

In the rapidly evolving society of the 21st century, it is acknowledged that students must be equipped with competencies that extend beyond cognitive understanding. 21st-century skills are meta-competences described as the development of reflective and cognitive skills in social, communicative, and creative domains. Schools are frequently the only option for the development of these skills. Despite the variety of learning and teaching methods employed in vocational education, it is evident that different approaches are necessary for the essential credentials. Therefore, education must move from conveying knowledge to developing individual potential through structured, project-based, and/or practice-based learning. Such metacognitive skills should be taught holistically through experience and reflection during project work.

The increasing complexity of daily life, globalization, rapidly changing technological developments, shrinking product cycles, and intensifying economic competition, and the innovative capacities of 21st-century skills necessitate the application of human and interaction-focused theoretical knowledge in a different context. In a world where complexity is increasing, meta-layer abilities such as collaboration and multi-disciplinarity, critical thinking, learning to learn, creating expertise, promoting creativity, and making interdisciplinary connections are becoming more vital. In this context, DT, which is a methodology with these characteristics, was deemed a suitable learning procedure, and the study was created accordingly. As a team-based learning method, Design Thinking is believed to assist teachers' use of holistic and practical constructivist learning approaches in their project-based instruction.

Economic globalization and the exploitation of human labor necessitate the establishment of political, industrial, and professional identities. Countries attempt to design policies that adapt to difficulties to promote competitiveness, mobility, transferability, and flexibility, differentiate themselves from competitors, develop systems, and produce and spread best practices. As a result, many models are produced, with educational models being one of the most essential. The education model is also inextricably linked to other models (economy, culture, politics, science, and so on) that comprise society and propel it forward. Economic, educational, and social factors have all had an impact on the concept of vocational training, as well as how, when, where, and to whom it is offered. There are numerous legal definitions for vocational education. These legal standards are crucial because they specify how and to what degree common funds for vocational training can be spent. The vocational training program is a strategic program designed to provide a qualified workforce at the medium level. As a result, vocational education curricula at the national and regional levels should include industrial, commercial, and other vocational disciplines.

Collaboration with industry should be established in the areas of vocational education quality, planning, implementation, and evaluation. A strategic program for acquiring a medium-skilled workforce is vocational education, which includes numerous industrial courses. The quality of teaching and learning in classrooms, workshops, labs and other educational settings is crucial to the operation of this educational system. Outstanding trainers and trainers alone are insufficient. There is also a sufficient number of materials accessible for the system to be effective for the students engaged, such as well-used courses and syllabuses, uploads that are appropriate for the purpose, and the excellence of any educational service. The real solutions for evaluating the results of vocational training are buried in the classroom and executive communication, that is, in comprehending many decisions as a result of "teachers" interviews with the audience. It is likely that the dominance of its pedagogy, rather than the first of VET systems, is derived from other education data, but the family is involved in the creation of education from a broader culture of learning, the fact that teaching content is closely linked to the requirements of a specific profession, collaboration with operators, communities, change, and it is critical to be open to development.

Many studies on the transition of VET exist in Europe, with the majority of them concentrating on specific industries and systems. VET education: (a) political and organizational regulatory frameworks for VET processes; (b) didactic-curricular orientation of VET processes; (c) defines Germany as the place of the vocational education process in the context of socialization under headings and adopts vocational education qualitatively with its structural and functional dimensions, as a country with representative power in this regard. According to him, the reason for this is the cooperative relationship that Germany has established between the state, industry, and education, the goals, and firsts of education for complex qualification profiles, and the importance of VET education, which creates a bridge between education and employment, and the creation of a unique education. VET education should always be examined from the perspective of societal and individual requirements. Individual abilities should be fully utilized to meet the demands of the economy. Individuals' internalized business demands are an important goal of vocational education. The existing literature suggests that VET should be taught in a problem-solving setting and that high-quality VET almost always incorporates a combination of methodologies. The finest VET learning is generally applied, practical, experiential, and real-world, and incorporates feedback, inquiry, application, and reflection, as well as theoretical models and explanations if needed. This is accompanied by an acknowledgment that any professional pedagogy must address other modern concerns such as shifting employer demands and new degrees and institutions. According to Georg (1997), the paradigm for explaining specific national disparities in mass job training should be expanded to include the constellations of dominating cultural and functional-structural interactions within a society, namely culture and structure. He believes that a society's values, norms, attitudes, beliefs, and ideals shape education systems, work organization, and professional relationships, as well as the more or less stable interaction between specific national job training and other social subsystems such as general education and various employment system paradigms. The architecture of VET systems differs significantly across European Union Member States, despite major social, economic, and cultural parallels and intersections. All European VET approaches, including one specific institutional or legislative model, appear to prioritize vocational, academic, and market orientation. Market orientation principles (for example, in vocational continuing education) and academic orientation (in practically all vocational schools) are major operational variables in the German system. The French educational approach combines a vocational and market orientation with an academic orientation. Even the very market-oriented British education model is organized around jobs and the specialized vocational subject system in the country's postsecondary institutions. Despite their national, economic, social, and cultural commonalities, these countries have distinct vocational education and qualification systems. The diversification of professional subjects shapes these systems in general.

If provided with: (1) facilities and adequate infrastructure; (2) educators; (3) cooperation between business/industry and schools; (4) a favorable working environment; (5) adequate funding; (6) a comfortable learning environment; and (7) when the learning process is fun, active, creative, and student-centered, vocational training can yield graduates who are competitive in the business world.

2.2   New Vocationalism

The concept of new vocationalism can be defined as the student developing his vocational education according to his own interests and abilities, rather than receiving a curriculum-driven vocational education. This paradigm is conducive to professional growth. In the context of vocational education, students acquire not only knowledge and etiquette, but also their talents. The purpose of vocational education is to prepare pupils for independent work. Therefore, the development direction of vocational education is focused on meeting labor market demand, and the macro aspect of vocational education relates to the demand-driven premise of vocational education development. The success of vocational education is determined not only by the success of the students in the learning process but also, as a result of these successes, by the performance of the graduates in the corporate world.

The curriculum is a reference to education and learning within the school system. The entire educational process is affected by centralizing the curriculum; educational institutions and teachers must be able to transform it into a language. It refers to the implementation of learning activities to achieve educational objectives, as well as the planning and preparations for objectives, content and learning materials, and tools used to direct them in accordance with the curriculum. However, curriculum design may allow students to engage in both practice and research challenges. When making professional decisions, can a single curriculum appeal to all students? How can the curriculum engage students in both the specifics and broad strokes of an educational scenario when making professional decisions? Vocational schools assist in bridging the skills gap between schooling and employment. In the traditional approach, students do not join the field of study with limited exposure to the tools and situations they will encounter on the job. Rather, students operate under the supervision of their teachers for the entirety of their course, particularly in these circumstances. When an educational institution implements an industry-aligned competency-based training strategy, this effect can be utilized even more.

Not only do students believe in their skills, but businesses/employers know they're making a good decision when they hire new employees and can expect them to thrive immediately. VET must be student-centered, not only in delivery but also in the idea of education and activities that promote the development of self-directed and independent learners. This is a shift in function and practice for VET trainers, who have traditionally trained and assessed job-related knowledge and abilities. Instructors must develop and conceptualize innovative ways for teaching trainees to be self-directed learners. This emphasis on compliance provides no room for teachers to build unique training methods. The cultural environment and focus should be adaptive rather than innovative.

If the emphasis is changed from assessment to presentation and assessment is given equal weight, VET may gain new flexibility. According to the theoretical model that serves as the foundation for this study, the growth of thinking necessitates proper learning areas that mirror the game and influence the students'

self-regulation in this process. These are comparison, interaction, and reflection places. "Allows us to conduct prepared acts of thought, such as decision making, debating a case, and other analytical, creative, or critical actions," which piques students' interest and fosters autonomy in their own learning processes. Pioneered the development of Design Thinking on the premise that their schools should be designers, fully engaged in the process of rethinking their "systems." The technique does not hold the teacher accountable for problem-solving. Rather, it enables them to identify the appropriate challenges to address and then discover solutions throughout the process. Teachers are members of an interdisciplinary team that collaborates with users and the school community to produce problem reporting and potential remedies.

IDEO (2011) proposes exploration, interpretation, idea development, experimentation, and evolution as the design thinking methodology for the educational sector. The IDEO (2011) method has assisted educators in becoming more adaptable and creative in their approach to solution creation. Design thinking, according to IDEO (2011), is a human-centered, collaborative, optimistic, and experimental mindset that thinks that individuals can make a difference.

3 Re-Framing the VET Approach

To examine the VET approach, it is thought that it would be healthy to first return to the main purpose of vocational education. In this section, the strengths and weaknesses of vocational training will be examined, and a needs analysis will be made. For this, the literature, and the outputs of 'focus group studies', 'surveys', and 'interviews' applied to the project partners were used.

3.1 The Institute of Technology and Education (ITB)

In Germany, young people study in the company and at school. The dual system, the central element of the German VET system, is called "dual" because training takes place at two learning venues: a company and a vocational school. Apprentices are employed during the apprenticeship by the company. The dual system looks back on a history spanning more than 100 years. It is ingrained in German society and characterized by the strong commitment of numerous sections of German society, including the state and federal states, industry, corporations, and social partners.

Each year, around half of Germany's school leavers opt for this type of vocational education and training. Learning takes place at two venues – the company and the vocational school. This means that trainees/apprentices are employees and pupils/students at the same time. They conclude a training contract with a company, where they undergo training in one of more than 300 training occupations (skills areas) recognized in accordance with the Vocational Training Act (BBiG) or the Crafts and Trades Regulation Code (HwO). Depending on the occupation, the duration of training is between two and three and a half years. Training may also be completed on a part-time basis. Apart from the provision that mandatory full-

time schooling must have been concluded, no further prior school learning requirements apply in respect of entry to dual training. Apprentices receive a training allowance from the employer, i.e., they get paid for their apprenticeship. A final exam which is performed by the chambers completes the apprenticeship. Upon passing the final examination, apprentices receive a chamber certificate (or a journeyman certificate in the case of a craft trades occupation) to document that training has been completed. This certifies that they own employability skills in one of the state-recognized occupations.

The expertise of teaching staff at the vocational school and of qualified and certified company-based trainers plays a major role in securing the quality of dual training. The combination of practice and theory which forms the basis of the dual system of vocational education and training in Germany is held in high international regard. This part of the VET system in Germany is based on cooperation between the state, private sector, and social partners. The Institute of Technology and Education (ITB) was founded in October 1986 and has since become a central scientific institution of the University of Bremen. With around 50 employees, it is one of the largest independent research institutions for vocational education and training worldwide. The four departments of the institute are headed by professors from the faculties 01 (Physics/Electrical Engineering), 04 (Production Engineering,) and 12 (Educational Sciences). The ITB offers two courses of study: A Bachelor's program (B. Sc.) and a Master's program (M. Ed.). Teachers qualified in vocational education and vocational science for vocational schools in the vocational fields of electrical engineering, information technology, metal technology, and automotive engineering are trained in the research.

The guiding principle of the ITB's research is the analysis and design of the interrelationship between technology, work and education. The focal point of the scientific work is VET research with the subject areas of initial and continuing VET and occupations and vocational training systems on the one hand and their demarcations and exclusions, transitions, prerequisites and alternatives on the other.

One of the VET schools in Bremen:

"The Technisches Bildungszentrum Mitte (TBZ Mitte)," in *English Technical Centre of Education of the City Centre*, was founded in the year 2000. With a variety of different educational programs, TBZ Mitte is the most efficient school with a technical orientation in Bremen. With the expertise of more than 100 teachers and certified master craftsmen, we have great pedagogical, professional, and general education know-how. We combine vocational education and training and general education for your benefit. We also support you in your future educational work with our international offers in the context of Erasmus +.

Dual vocational education and training (Vocational School) is supported in ITB. The apprentices of TBZ apprenticeships are regularly among the best in the nationwide skilled worker final examinations. Here you

can get an overview and receive information about our training occupations in the following occupational areas:

- Electrical engineering
- Metal Technology
- Traffic and Vehicle Technology
- other professions.

In the educational program "Double Qualifying Vocational Training "the entrance qualification for senior technical colleges can be achieved.

Higher education entry qualification programs (full-time)

In the study areas of our **vocational high school of technology** (BGT)
- Information Technology
- Mechatronics
- Aerospace Engineering
- Technology and Management (NEW from 2021/2022!)

ITB has high technical and pedagogical competencies and a combination of these to support a successful start into a professional or academic career. Innovation, imagination, flexibility, and fun in learning are no foreign words for the school. In the BGT, the general university entrance qualification (Abitur) is also obtained.

After having completed vocational training, in our one-year **higher secondary vocational school (Fachoberschule Technik, FOS)** students are prepared for a successful education at the University of Applied Sciences (Fachhochschule).

Pre-vocational training programs (full-time)

The university also supports the **preparation for vocational training** through its practice-oriented educational offers and helps candidates enter professional life in their educational programs. Furthermore, ITB also supports students in **continuing education and training**.
- Werkschule Technik (three-year course of vocationally qualifying education, class 9-11)
- Pre-Vocational Technical School (Berufsvorbereitende Berufsfachschule Technik)
- Language Support with Professional Orientation (SoBO or Vorkurs)
- Professional Orientation with Language Support (BOsP)
- Professionally Qualifying Technical Vocational School (BFSq)
- Bremen Vocational Qualification (BQ)
- Workshop phase for ten-class general education secondary schools (Oberschulen) and support centers.

3.1.1   The institution's approach to vocational pedagogy

1. Role of the teacher.

Teachers are experts in learning: their core task is the targeted and scientifically based planning, organizing, and reflecting on teaching and learning processes, as well as their individual assessment and systemic evaluation. They impart basic knowledge and skills in methods that enable the individual to independently master the process of lifelong learning. For professional work, comprehensive specialist scientific as well as pedagogical-didactic, and sociological-psychological competencies as well as communicative and social skills are required.[1]

2. Nature of activities.

Their core task is the targeted and scientifically based planning, organizing, and reflecting on teaching and learning processes, as well as their individual assessment and systemic evaluation. They impart basic knowledge and skills in methods that enable the individual to independently master the process of lifelong learning.[2]

3. Means of knowing.

The Dual System combines the learning of theoretical and practical knowledge in two venues: VET school and company. The VET teacher is pedagogically trained and teaches the apprentices during their school days. The VET trainer is an employee of the company who has all the practical knowledge and skills to teach the apprentices during their time in the company.

4. Attitude to knowledge.

German VET-school curricula are structured in so-called "learning fields" (Lernfelder). Each vocation consists of ~10 of those fields; the estimated time for each field is ~100 hours. The fields are a holistic set of knowledge, skills, and competences (KSC), and concepts of general subjects like physics or economics are embedded – not taught separately.

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[1] https://www.kmk.org/fileadmin/Dateien/veroeffentlichungen_beschluesse/2000/2000_10_05-Bremer-Erkl-Lehrerbildung.pdf
[2] https://www.kmk.org/fileadmin/Dateien/veroeffentlichungen_beschluesse/2000/2000_10_05-Bremer-Erkl-Lehrerbildung.pdf

5. Organization of time.

There is a timetable that is different for every profession. Some apprentices attend school for 2 weeks and have in-company training for the following 6 weeks. Others spend 1 day each week in school, the other 4 days in the company.

6. Organization of space.

In VET schools the apprentices learn in classrooms. Some professions might even have a workshop there to teach hands-on. In the company the main learning venues are work-based, might be in the different departments or on various construction sites. Most big companies run workshops for their apprentices.

7. Approach to tasks.

The tasks depend on the subject learned and the pedagogical method applied. There is a variety to choose from and both teachings are applied: group work but also helping the individual if needed or if there is only one apprentice in an SME where the vocational training takes place.

8. Visibility of processes.

For in-company training, the occupational competencies to be acquired are specified in a training regulation, which is specified by the training company in an individual training plan. Framework curricula are drawn up for occupation-related instruction at vocational schools for all recognized occupations that are coordinated with the respective training regulations in terms of content and timing.

9. Proximity to teacher.

This depends on the number of students and apprentices in the workplace.

10. Role of the learner.

Depends on the method and the tasks. There are a lot of tasks that are self-managed but at the same time, some are directed.

3.1.2   Interviews with the institution

1. What is happening in practice when vocational education is a really positive experience for learners and teachers?

Students need to feel that their teachers have "a heart" for them, are interested in their individual living conditions and learning opportunities, and encourage and motivate them, accordingly, challenging but not overburdening.

Responsibility, willingness, and credible action on the part of all teachers, also for a good school climate and a school life based on partnership, are conducive prerequisites for this. For this, the practical cooperation of the teachers is required and necessary, especially in the credible teaching of team skills to the learners.[3]

2. What is the ultimate goal of vocational education?

To prepare the apprentice for the conduction of the job they learn. To provide the knowledge needed, to train them hands-on by using the method of work-based learning. Additionally, digital competence should be acquired during the time of vocational education and training. The main objectives of vocational education and training are to establish and expand employability skills, provide preparation for the acquisition of such skills, and ensure that they are retained.

3. What is distinctive about practical and vocational learning?

In the dual system, training takes place at two learning venues: in the company and at a vocational school. Vocational training aims to provide the necessary competencies and qualifications to perform a skilled job in a changing world of work. It is also intended to provide the necessary work experience. Successful completion of the program qualifies the trainee to work directly as a qualified specialist in one of the 330 or so recognized occupations that currently require training.

4. What are vocational learners experience when they are learning well?

Vocational education is a different learning option from the path of college or university. It offers a path that imparts the skills and knowledge needed. There has been a growing emphasis on providing students in vocational education and training (VET) with workplace experiences.

5. What teaching methods work best?

There are many different ways of learning and training. The list shows methods of good pedagogy in vocational education.
1. Learning by watching
2. Learning by imitating
3. Learning by practicing ('trial and error')
4. Learning through feedback
5. Learning through conversation
6. Learning by teaching and helping

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[3] https://www.kmk.org/fileadmin/Dateien/veroeffentlichungen_beschluesse/2000/2000_10_05-Bremer-Erkl-Lehrerbildung.pdf

7. Learning through real-world problem-solving
8. Learning through inquiry
9. Learning by critical thinking
10. Learning by listening, transcribing, and remembering
11. Learning by drafting and sketching
12. Learning on the fly
13. Learning by Reflecting Learning by being coached
14. Learning by competing
15. Learning through virtual environments
16. Learning through simulation and role play
17. Learning through games

6. What sources of knowledge, expertise, and best practice do teachers use to help them teach well?

The founding of teachers' expertise is dedicated study programme of 5 years, followed by an internship in a VET school of 18 or 24 months (Referendariat). Teachers are asked to learn from colleagues, apply teamwork, and visit further education programs.

7. What could make vocational teaching and learning even better?

To decrease the number of teaching hours and to increase the time for further education (new technologies, new teaching methods, how to deal with diversity…).

8. What are the challenges for creating outstanding vocational teaching and learning?

* The lack of time and VET teachers.
* They are state clerks: Once they have mastered the challenging study program/internship, teachers are lone warriors, if they do not want to develop themselves, no one can force them.

9. How might these challenges be overcome?

* Increasing the number of teachers with more attractive study programs (salary is very good).
* Increase the number of hours for mandatory further education.

10. What kinds of things might be included in a vocational pedagogy?

There is already a broad offer of pedagogy; as mentioned earlier: Not enough teacher further educates themselves.

11. How can we make sure that a vocational pedagogy is useful and draws both on best practice and best thinking?

Via evaluating the learning outcomes in a classical 2*2 research setting. (Trial group and control group)

12. What are the generic outcomes for which vocational education ought to aim?

"The aims listed are aligned towards the development of employability skills. Employability skills within this context are defined as the readiness and ability of a person to conduct himself or herself in an appropriate, considered, and individually and socially responsible manner in social, occupational, and private situations.

Employability skills are developed within the dimensions of professional competence, personal competence, and social competence.

Professional competence describes the readiness and ability to use specialist knowledge and ability as a basis to solve tasks and problems in a target-oriented, appropriate, methodologically suitable, and autonomous manner and to assess results.

Personal competence describes the readiness and ability to act as an individual personality in clarifying, considering, and assessing development opportunities, requirements, and restrictions within the family, within an occupation and within public life, to evolve individual talents and to make and further develop life plans. Personal competence encompasses such personal qualities as autonomy, critical ability, confidence, reliability, and a sense of responsibility and duty. It also particularly includes the development of considered values and self-determined loyalty to values.

Social competence describes the readiness and ability to develop and live out social relationships, to detect and understand areas of affinity and conflict and to deal with and reach understanding with others in a rational and responsible manner. It also particularly includes the development of social responsibility and solidarity.

Methodological and learning competence arise from a balanced development of these three dimensions.

Competence describes successful learning in respect of the individual learner and the equipping of him or her with the ability to act autonomously in private, occupational, and social situations. In contrast to this, qualification is defined as successful learning in respect of the usefulness of competences within the context of the demand for such competences in private, occupational and social situations (cf. German Education Council, recommendations of the Educational Commission for the Reorganization of Upper Secondary Education)."[4]

14. What are effective learning and teaching methods in vocational education (like through conservation, feedback, practicing, real-world problem-solving, imitating, competing, etc.)

See question 5.

15. Is design thinking a useful approach for school development in vocational schools?

Yes, as one of the toolsets in the methodological toolbox.

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[4] https://www.govet.international/de/54899.php

3.2 Private Ankara Chamber of Industry (ASO) Technical College Vocational and Technical Anatolian High School

Private Ankara Chamber of Industry (ASO) Technical College Vocational and Technical Anatolian High School was established in the 2012 - 2013 academic year with the motto "Education is the main essence", in the 1st Organized Industrial Zone of the Ankara Chamber of Industry, along with making a difference with its vision and mission, which is a revolution in vocational education. ASO maintains this vision by educating its students with the objectives of 'Superior academic education, High-class vocational education, Advanced foreign language education, and Improved Personality'. ASO Technical College advances by putting new ones on top of the previous successes every year with the idea of "If we have the same success as the previous year, we are going backward.". Private Ankara Chamber of Industry (ASO) Technical College Vocational and Technical Anatolian High School, which doesn't nurture intermediate staff for industry, but trains "Qualified Engineer Candidates" with the aim of a four-year university, teach 70% academic and 30% technical lessons to its students within the scope of the Private Anatolian Technical Program in the Turkish National Education System.

The school, which achieves the goal of a good academic education at the highest level every year, provides both high-quality education and free university preparatory education to its students in its classrooms equipped with smart boards. In addition; screening - monitoring - development exams are applied to the students which monitor both their success and incomplete educational activities, and provide reinforcements, when necessary, within the scope of the 'Continuous Self-Controlling System' developed with the idea that 'Unsupervised process cannot be improved.'

Knowing that science education is also a major part of academic education, Private Ankara Chamber of Industry (ASO) Technical College Vocational and Technical Anatolian High School teachers conduct applied academic courses with their students in fully equipped Physics - Chemistry - Biology - STEM laboratories. ASO Technical College, which realizes a good vocational education target at a high level every year, provides the applications and projects it carries out in its fully equipped workshops and laboratories. The students of the school, who have made a name for themselves in the competitions they participate in or on different platforms, demonstrate their difference regarding their professional qualifications, both during their student years and when they graduate.

ASO Technical College, which aims to achieve the goal of good foreign language education at the highest level every year as well as its other goals and raise "World People", makes important contributions to its students' language development, by providing the opportunity of English Level System in the 9th and 10th-grade students. With its intensive language programs after the 9th grade, our school keeps its students subject to strict education until graduation. Our students, who have succeeded in the International

Language Olympics and language conferences one after the other, are firmly prepared for the business and social life that awaits them in the future.

Private Ankara Chamber of Industry (ASO) Technical College Vocational and Technical Anatolian High School, which challenges the life of qualified engineer candidates beyond all goals, gives importance to moral and personality development at least as much as other goals. Among the developed personality applications, no lesson bell has been practiced since the day it was established to instill "Time Management" awareness in its students. Students, who follow the start and end times of the lessons from the smart boards in their classrooms or the clocks in the school corridors, take their places in their classrooms without any warning from their teachers. Our school, which wants to create the concept of "honesty" not in words but in behavior, does not employ any staff in the canteen. Students buy bagels or similar products that come to school for breakfast from the platform, leave the price in the box there, and if necessary, they calculate the change themselves and take it from the same box. This application is sustained excellently since 2012. Also, there is a chest on the ground floor. This box is called a "Money Chest", from which students who cannot receive pocket money from their families or who need a certain amount of money at the moment can get as much money as they want. School management, wanting students to learn to pay their debt on time, did not put any official at the head of this money chest. Students receive this training by noting the amount of money they receive and the date they will return in the notebook next to the money chest, in line with their own needs. Again, this application is also sustained since 2012.

Inhabiting the motto "Education is the main essence" at the highest and extreme points, Private Ankara Chamber of Industry (ASO) Technical College Vocational and Technical Anatolian High School starts its activities by internalizing being the best in education with all its teachers and administrators at the beginning of each academic year.

Departments

The school consists of 4 departments: Electrical and Electronics Technologies, Industrial Automation Technologies, Machinery and Design Technologies, And Motor Vehicle Technologies.

Electrical and Electronics Technology: This department covers the energy supply, operation, and control of lighting, machinery, motor, and electrical appliances in all living areas and working areas, including transmission, and distribution, starting from the production stage of electricity. In short, it covers all the energy and Technologies that make life easier and more modern. Since electrical electronic developments affect large areas of industry and are of strategic importance in all countries and special planning, is carried out in these sectors in cooperation with the sector and the state. As competition increases in the globalizing world, studies and developments in this area are becoming more important. Countries produce special

policies to increase the competitiveness of the industry; technical education supports the development of educational environments in cooperation with the industry.

Industrial Automation Technologies: The concept of industrial automation has led to significant changes in industrial technology production and engineering education, which has affected design philosophy and engineering education in particular. Today, robot technology is widely used in every field, meaning industrial automation technology is needed.

Machinery And Design Technologies: It is the discipline that forms the basis of mechanical engineering, which is the oldest and the widest engineering field of engineering activities. It not only performs studies related to the design, analysis, manufacturing, and maintenance of mechanical systems using physics principles and material technologies, and presents analytical solutions to problems by mathematically modeling physical events and situations. This is the area where technical personnel is trained to perform maintenance and repair of all systems on machines and to manage all the settings and controls of these machines which can operate classic and computer-controlled machining machines and use machine parts by producing numerical code.

Motor Vehicle Technologies: The motor vehicles sector is in continuous and rapid development as a result of rapidly changing market and competition conditions at the global level. The sector is defined as the whole of the factories, authorized and private services, and private and official institutions, including repair maintenance workshops, which are established to manufacture vehicles, construction machines, and after-sales services used for human and cargo transportation in Turkey and the world. The sector needs individuals who can perform maintenance and repair of mechanical systems of vehicles, automotive electromechanical systems, mechanics, electrical electronic, and hydraulic systems of work machines, automotive bodies, and automotive paint in the field of motor vehicles and who can develop themselves by following professional developments.

3.2.1 The institution's approach to vocational pedagogy

1.   Teacher's role

Many of the technical teachers in our school continue their postgraduate education academically as well as their undergraduate education. In addition, they continue their vocational training and practices, where they can follow the current technology.

2.   Nature of activities

For the excellence of the professional activities in our school, our technical teachers shape and constantly update their activities with both project studies and their workshops.

3.   Means of Knowing

Our technical teachers reach all kinds of information by closely following all the developments in the world in their own and related other fields. Fairs, national and international competitions, events, and factory visits are among the most important sources of information for them.

4.   Attitude to knowledge

Since our school provides a theoretical and practical education, it is highly important to synthesize the two items. To achieve this goal, the framework elaborated by Bloom is implemented as an inspiration to our education system. This framework consists of six major categories: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. The categories after Knowledge are presented as "skills and abilities," with the understanding that knowledge was the necessary precondition for putting these skills and abilities into practice.

5.   Organization of time

Time management, which is among the general education policies of our school, is important for both our teachers and students. They plan the time for the work and projects they will do, as well as the workshop/laboratory work in their classes, and complete their work on the full day accordingly.

6.   Organization of space

The workshops and laboratories of our school are equipped with the most up-to-date technology. Our students do not wait in line to practice. A maximum of two Students per machine. For this reason, the organization of the space is determined in advance in the projects and workshops at our school and those spaces are actively used throughout the academic year.

7.   Approach to tasks.

Technical teachers in our school determine all the responsibilities they will take on their own. In other words, at the beginning of the academic year, each Technical Teacher notifies the school administration of the project they want to do or the national international competition/activity they want to participate in. After the necessary equipment is provided by the school administration, they start their work and do this completely for the development of the student. They manage and successfully complete all processes in every task they receive.

8.   Visibility of processes

All projects and workshops are carried out on materials designed as standard by our technical teachers. These materials contain technical images and information. In addition, the works are exhibited in the school, and national and international competitions and events, ensuring their visibility.

9.   Proximity to the teacher.

The Technical Teacher staff in our school consists entirely of teachers who have received technical and academic training in their fields along with pedagogical knowledge. We believe teachers should reduce the physical distance between themselves and students as a way to remind behavioral expectations. In our school, proximity control is carried out as an effective classroom management strategy that increases our students' engagement, reduces problem behaviors, and encourages positive improvements.

10.   Role of the learner

Students at our school are students who want to become engineers in the future. We choose which students to register at our school. As a result of the central exam held in Turkey, a maximum of 144 students are admitted to our school every year, among the students who have a 5% success rate in Turkey. These students grow up as qualified engineer candidates in their fields. Absolutely no standard vocational education curriculum is applied. We professionally prepare our students for many applications and programs where they will make a difference in the national and international arena. When our students graduate from school and start their higher education life, they have at least the same or even higher technical knowledge than an engineer who graduated in that field. They climb the career ladder successfully with national and international programs/competitions that they will carry out or participate in during their higher education.

3.2.2   Interviews with the institution

1.   What is happening in practice when vocational education is a positive experience for learners and teachers?

> The vocational training program of our school has been created to train qualified engineer candidates who meet the basic requirements of the Turkish National Education System. These students and teachers carry out educational activities from the richest workshops and laboratories in Turkey. As a result of all the work done so far, our school's graduate students have started to work in the engineering staff of Turkey's most distinguished factories. Qualified workshop and laboratory work, internships, crisis and time management skills, work disciplines, and successful work in all applications that they have acquired throughout their secondary education life distinguish them from other engineers with the title of engineer.

2.   What is the ultimate goal of vocational education?

The ultimate goal of our school's vocational training is to train engineer candidates who can raise the Turkish Industry to the highest level of the world, with qualified application and technical knowledge. In this direction, innovative education and training practices, improved personality practices, and training are provided to manage any crisis they may encounter in their professional life. At the same time, they get the opportunity to see the workplace culture and production activities on-site with the internship programs they are involved in.

3.   What is distinctive about practical and vocational learning?

Conducting the training in real production environments carries the qualified engineer candidate to a very different point from an engineer who only received theoretical training after the training process is completed. An engineer who has a good command of the application processes can follow the entire field and perform the necessary directions efficiently. This allows the quality of production to increase, the personnel and works they are responsible for to be managed correctly, and the resources to be used extremely efficiently.

4.   What are vocational learners experience when they are learning well?

Our students and teachers examine all current production plans and problems during their work in workshops and laboratories. These problems allow them to analyze their solution processes more accurately and to produce excellent work as a result. At the same time, since the teachers who train the students follow the current technology in their fields, their continuous development is automatically ensured.

5.   What teaching methods work best?

Only the theoretical teaching of the relevant subject remains only an abstract thought for the student and the teacher. At the same time, only practical training causes us to stay away from the science of the job. For this reason, it will be the right method to give both theoretical and practical training to students and teachers in a way that can be managed correctly. This will directly affect the project, time, and business management activities and will give them very important competencies. In the internship programs they are involved in at certain periods of their education life, they learn how to use the practical and theoretical education they receive at school in production.

6.   What sources of knowledge, expertise, and best practice do teachers use to help them teach well?

The teachers in our school learn about the current technology in their fields by following the internet, fairs, projects that have been done and are in progress, and academic publications. At the same time, within the framework of vocational education, they design their workshop and laboratory practices, by constantly updating them, wherso thaty can transfer basic skills in their fields to students. They have the students implement the application activities and projects they have designed in a way that will not allow any skill set to be lacking in students, in accordance with their time and plan throughout the year. Teachers who share all the resources and good practice examples they have obtained with the students also involve the students in the research processes.

7.   What could make vocational teaching and learning even better?

Vocational education will be successful as long as it is done in a production environment. It should be the top policy of the country administration that the workshops and laboratories of schools or all institutions carrying out vocational training activities should be of a similar high level. Education should be determined as the only solution, not the biggest problem of a country. Contribution to vocational education should be provided by providing basic skills training to students at all levels. Apart from vocational education institutions, all students who want to become an engineer should not have a diploma before completing their vocational education process.

8.   What are the challenges for creating outstanding vocational teaching and learning?

Not seeing vocational education as one of the most important elements of development in the country's policy negatively affects the quality of vocational education activities. Considering the qualifications of the schools, the vocational education institutions of the country are filled with the most unqualified and hard learners. In the current process, the encouragement of vocational education and the studies related to this have been insufficient. For this reason, overcoming all difficulties primarily depends on the management and implementation of the vocational education policy at the highest level.

9.   How might these challenges be overcome?

Vocational training requires a large investment and process. The most important solution is to manage the country's finances correctly and to allocate a large share in terms of investment in vocational education. One of the biggest elements of a country's development is possible if the industrial activities in the country are capable of setting world standards. This applies to both production and education. At the same time, all teachers and engineers giving vocational training must be experts in their fields, have practical skills and theoretical knowledge at a high level.

10.   What kinds of things might be included in a vocational pedagogy?

All people who teach in the relevant field must be experts in their fields. Programs, in which all teachers, engineers, and academicians who provide engineering education can make real applications in their fields, should be created and made compulsory. Teachers, engineers, and academics with advanced professional standards should share and follow their work in this field with all educational institutions. The system should be planned purely to increase the efficiency and quality of production activities.

11.   How can we make sure that a vocational pedagogy is useful and draws both on best practice and best thinking?

The efficiency of vocational education will only show itself in the process. When qualified engineers and engineer candidates reach the level where they can impose the projects they will develop or the R&D processes they will experience, vocational education will be one step

closer to their ultimate goals. Vocational education will reach the required quality level when the work to be done by teachers, engineers, and academicians who have adopted continuous development and learning as their basic philosophy, finds a place in the development of the technology of the relevant field in the world, and when it is ensured that this also becomes a country policy.

12.   What are the generic outcomes for which vocational education ought to aim?

Vocational education should contribute to the development of the country's industry. Instead of teaching outdated technology, the education of current and future technology should be the general approach of vocational education. The correct management and direction of all processes that may arise as a result of this, also constitute the general results that vocational education should aim for.

14.   What are effective learning and teaching methods in vocational education (like through conservation, feedback, practicing, real-world problem-solving, imitating, etc.)

The most effective learning in vocational education is to be able to manage the skills acquired by practicing in the relevant field behind theoretical education. Qualified engineer candidates are individuals who not only have technical education but also have a good command of management processes. Applications that will enable them to solve real-world problems, applications that provide demonstration, and application methods will be effective. Creating a competitive environment and keeping it under control with the right methods will contribute to the quality of vocational education. Ensuring that students and teachers express and exhibit their projects in the right places is an important part of development.

15.   Is design thinking a useful approach for school development in vocational schools?

Design thinking should definitely be included in the educational processes of all schools providing vocational education. Design-oriented thinking, which is a method in which students and teachers can use and even develop their imaginations at high levels, allows problems to be solved with the most effective and correct methods. It is not possible to solve a problem without abstract thinking skills. Design thinking enables students and teachers who receive vocational training to be individuals who dominate the process, not the result directly.

3.2.3   Focus group meeting results

1.   Role of the teacher – facilitative/didactic

Facilitator: Teachers who carry out educational activities with the right methods always show their students how to manage the process and how to facilitate the solution. A teacher who is competent in the field of a big problem whose solution is based on a simple method can easily convey it to his student with the right solutions. For this, it requires the teacher to have abstract thinking skills and design-oriented thinking skills.

At the same time, students who learn what it means to manage the process also search for solutions to the problems they will encounter in the future with facilitating methods.

2.   Nature of activities – authentic/contrived

-

3.   Means of knowing – practice/theory

Practice: Practical applications are the way to enable qualified engineers or scientists who can solve real-world problems to master the process. However, we cannot ignore the theoretical tools here. Because the solution must be based on scientific foundations, it requires the right knowledge and practical application applied with the right methods.

4.   Attitude to knowledge – questioning/certain

Questioning: The way to reach the right information is through questioning. A scientist who follows the process must question all kinds of data.

5.   Organization of time – extended/bell-bound

Extended: Process is more important than the result in solving a problem. Any work that will create processes is based on time. This time is required for the process to be managed with discipline by the people who will solve the problem, make a plan, fully comply with the plan, and stick to it.

6.   Organization of space – workshop/classroom

Workshop: It is the workshop environment where qualified engineering education and vocational training are also given. A vocational education without production elements is unthinkable.

7.   Approach to tasks – group/individual

Group: Teamwork should be among the basic skills of all qualified engineer candidates and vocational education students. All individuals who want to continue their future professional life successfully should adapt to teamwork and group activities.

8.   Visibility of processes – high/hidden

High: Although the final goal is the result of solving the problem, the processes that will lead to the solution are much more important. At the same time, high visibility should be ensured for these processes to be a source of solutions to similar problems.

9.   Role of the learner – self-managing/directed

Self-managing: Students who are managed with the right methods are prepared for their future professional life. This management process can lead to systems that can manage themselves after a while. This ensures the accuracy of all the methods in practice and the training of individuals who are ready to solve new problems.

3.3   Design Thinking and its application to VET

Design thinking is an active, reflective, and non-linear process that can provide new experiences and knowledge that enables participants to build on their current realities. Design thinking is a structured process that includes a driver or facilitator that keeps the team on task and the right track. Design thinking is an interdisciplinary problem-solving approach that is user and human-centered. People are selected as active participants in the process. Participants solve user problems by researching users to gain common sense, then propose and develop solutions through a process of idea generation, prototyping, and implementation. Failure is valued as a learning and development process; it is perceived as an opportunity to do better.

Teaching is a systematic project consisting of many interconnected, interactive elements. Instructional design is a process based on the analysis of learning needs to achieve the best purposeful teaching effect. Evaluation of competence should not be limited to the educational setting and should be based on existing workplace skills, knowledge and practice, and actual skills. This observation further complicates the role of the VET trainer, as their ability to design and deliver relevant training and assessment largely depends on their access to available resources, facilities, equipment, workplaces, and the opportunity and time to keep up to date with information. Examining the educational and organizational implications of design thinking requires a multidisciplinary theoretical approach, similar to design thinking, that acknowledges the instability of environments and focuses on opportunity identification, innovation, and innovation. As a practical approach to identifying and creatively solving various problems, design thinking develops managerial dynamic capabilities; This development facilitates organizational development. Vocational learning opportunities play a critical role in skills development and employability. The importance of professional development can be summarized to a large extent as the difference between theoretical knowledge and practical skills. In non-professional studies, students often spend hours of their time exploring a variety of different topics. Class times tend to be only a few hours per week, as they spend a lot of time in the library and on computers doing research and writing articles that help them continue to develop their theoretical knowledge in various fields. It includes monitoring the thinking processes, checking if progress is being madetowards the desired goal, and ensuring accuracy. To learn to think critically, students can be taught metacognitive strategies to help them control their thinking processes. Reflection is an integral part of learning. Reflective intelligence may be required to reshape and change

young people to develop more effective thinking. Learning becomes effective as individuals evaluate and rethink existing thought and behavior patterns. "Learning by Doing" is the essence of VET. Practical learning takes precedence over theoretical learning. Students in vocational schools spend significantly more time practicing concrete skills they will need and can apply in the workplace. The focus of their studies is to gain the knowledge and competencies they need to work competently in their chosen field. With this style of learning, work experience becomes a real part of the course itself, rather than something to follow through internships or low-level jobs outside of course time. Students have the opportunity to graduate with practical experience in their chosen field, which helps them adapt once they start their full-time jobs.

Within the scope of the project, a questionnaire about DT was applied to VET Educators and Educator Candidates. The survey examines education professionals' problem-identification and solving habits, their approach to creative learning in practice-based education, their knowledge of design thinking tools and methodologies, and their skills in design thinking tools and methodologies. The questionnaire explores the perceptions of educators and educators through a total of 47 items grouped in 5 scales from an extensive literature review on learning contexts as areas of reflection. Persons reflection skills (7 items); creative thinking features (12 items); learning awareness (7 items); the role of the teacher (6 items); problem-solving skills (6 items); and learning and skills development assessments (3 items). Lickert-type scales with numerical values from 1 to 5 were used, with 1 representing the lowest (strongly disagree) and 5 the highest (strongly agree).

4 ANNEXES

4.1 ANNEX-1

The Human Research Evaluation Board of TOBB ETU gave their stamp of approval on the questionnaires after conducting an ethical review of the project's operations.

Evrak Tarih ve Sayısı: 31.08.2021-E.9666

T.C.
TOBB EKONOMİ VE TEKNOLOJİ ÜNİVERSİTESİ
İnsan Araştırmaları Değerlendirme Kurulu

Sayı : E-27393295-100-9666   31.08.2021
Konu : 2021-30 Numaralı Başvuru

Sayın Dr. Öğr. Üyesi Arda Bülben YAZICI

İnsan Araştırmaları Değerlendirme Kurulu'na etik yönden değerlendirilmek üzere sunmuş olduğunuz 2021-30 kayıt numaralı " DT4VET: Educating Designerly Thinkers for Vocational Education and Training: Design Thinking Tool for Educators " başlığını taşıyan projeniz etik yönden uygun görülerek onaylanmasına karar verilmiştir.
Bilgilerinizi rica ederiz.

Prof. Dr. Tayyibe Nur ÇAĞLAR
Kurul Başkanı

Bu belge, güvenli elektronik imza ile imzalanmıştır.

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Kep Adresi:tobbetu@hs01.kep.tr

Bu belge 5070 sayılı Elektronik İmza Kanununun 5. Maddesi gereğince güvenli elektronik imza ile imzalanmıştır.

4.2   ANNEX-2: Questionnaire for VET teachers

This questionnaire is designed for the **"DT4VET: Educating Designerly Thinkers for Vocational Education and Training: Design Thinking Tool for Educators" Project** which is supported by the EU- ERASMUS+ KA202 Program. It will be used for setting a mindset toolkit. The core objective of the project is to train VET trainers about the Design Thinking (DT) concept, methodology, and implementation. The information you provide is confidential. Thanks for your cooperation, your participation is extremely valuable.

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1. *Do you accept participating in this questionnaire considering the information provided above?*

   ☐ Yes ☐ No

2. *How long have you been working in the teaching profession?*

   ☐ 0-5 years
   ☐ 6-10 years
   ☐ 11-15 years
   ☐ 16-20 years
   ☐ Above 20 years

3. *How old are you?*

   ☐ 18-20
   ☐ 21-29
   ☐ 30-39
   ☐ 40-49
   ☐ 50-59
   ☐ Above 60

4. *Gender*

   ☐ Female
   ☐ Male
   ☐ Other

5. *In which country you are working?*

   ☐ Turkey
   ☐ Germany
   ☐ Italy
   ☐ Other (Please specify: …)

Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".

6	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I can learn things but I cannot change my intellectual level.					
I can make changes to defined practices.					
I don't mind if I make mistakes while learning new methods.					
I question myself about what I learned after a discussion.					
I can transfer what I have learned through my experiences, feelings, and attitudes.					
Sometimes I get angry when I receive comments about my work performance.					
I always try to turn constraints into opportunities.					
I am aware of how to transfer my new knowledge to my professional life.					
I question the reflections of my contributions to be able to do better.					
While learning new information, I realize how much I already know.					
I always appreciate feedback for professional development.					
I can understand how users feel intuitively					
I have self-esteem to share my ideas with my team.					
I am able to change my mind when learned a different information.					

7	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
As I learned new methods, I changed my perspective on myself.					
I become more creative as I learn about my own weak points.					
Design thinking helps me plan my day better.					
My experiences and their stories strengthen me in communication.					
I am aware of my strengths in learning.					
I recognize play as part of learning.					
I am open to new experiences.					
I can design for, or with, a different culture.					
I give value to stories.					
I respect learning to learn.					
Design tools can be used to create a new experience.					
I can use a Design Thinking Toolkit specifically prepared for trainers.					
Design Thinking is a method created for an enjoyable learning experience.					

8	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am aware of the cultural values and religious beliefs of other cultures.					

I change my non-verbal behavior when it requires cross-cultural interaction.					
I can behave differently to suit different cross-cultural situations.					
I can design courses that integrate technology, information, and systems.					
I am able to create a reliable environment in the classroom.					
I am confident that I can socialize with local people even in a new culture.					
I can formulate in-depth discussion topics about content knowledge.					
I can facilitate students' online collaboration with appropriate tools.					
I give the instructions in a clear and understandable way.					
Teaching is a process not an outcome.					

9	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I welcome different kinds of feedback about my work.					
Trying new things is stressful for me, so I avoid it.					
I value when other people give me ideas that I can develop.					
I question myself about what I am learning through conversations.					
I question other people's solutions to have more variety to find better ones.					
Sometimes I can solve a problem without thinking about it.					
I believe it is necessary to create a new model for existing technology.					
I can formulate in-depth discussion topics about content knowledge.					

10	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I prefer to focus on the big picture and leave the details to others.					
I think nothing can make the world better.					
In problem solving process, I focus on the interactions.					
When solving problems, I optimize every part of the project.					
I analyze tasks broadly to find a solution that will have the greatest impact.					
I try to delegate the problem to find a quick solution.					
In order to solve the problem, it must first be framed.					
I always learn from my mistakes.					
It is necessary to have training to identify and formulate the methodology.					
I can create a fictional character to understand the user needs and visualize it.					

11	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I easily take initiative when noticing things.					
I easily collaborate with others.					

I cope with ambiguity and risk, also in situations when things do not go well.					
I learn from experience.					
I can motivate other and be an example myself.					
I plan and envision activities, and I am open to divert the plans when needed.					
I value ideas of the others too.					
I manage to spot opportunities also in unusual and negative things.					
Inner motivation drives me and I do not easily give up when things do not go well.					
Prototyping, iteration, experimentation, collaboration, and brainstorming are tools of Design Thinking Process.					

12	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I need to continue self-education to become a qualified trainer.					
Academic knowledge is not applied in vocational high school education.					
I organize real-life activities for students.					
I like to get ideas from people who have a different point of view than mine.					
I hope to gain general knowledge in more than one discipline.					
I design lessons that integrate content, technology, and pedagogy.					
I can transmit my knowledge to my experiences, attitude and feelings.					
I can create real-world problems about content knowledge.					
I design courses for student-centered learning.					
I am aware of my difficulties in the learning process.					
Learning should be connected with theory, practice, and experience.					
Design Thinking is a skillset requiring technical training.					
Design thinking always needs a toolbox ready for use.					
Learning is a process not an outcome.					

13	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I often learn from my peers.					
I need to supervise others when working together.					
I prefer working with people.					
I think teamwork is effective.					
I try to create spaces where my students can develop ideas together.					
Team members actively acknowledge each other's contributions.					
The team works together to develop solutions to relationship problems.					
The team creates task performance strategies for team members.					
The team has ensured that the task performance goals for the members are clear.					

My unique skills and abilities were valued in this team.					
People on this team sometimes reject others for being different.					
A practice-based teacher should be open to transformation and improvement.					
I can translate tasks into clear, simple wording for cross-disciplinary teams.					
I always prefer to work alone.					

14. **Designerly Thinking** means; in my opinion,	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
critical thinking and problem solving					
speed-thinking and adaptation					
curiosity and imagination					
communication and leadership					
creating a common language					
setting common priorities					
creating three-dimensional, tangible objects					
analytical thinking					
being open to teamwork					
developing empathy skills					
ability to observe					
knowing end-user needs					
competition					
familiarity to real-life practices					
solving societal problems					
developing new knowledge and skills					
15. Other (Please specify):					

16. **Designerly Thinking** means; in my opinion, is useful for Vocational Education and Training for;	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
critical thinking and problem solving					
speed-thinking and adaptation					
curiosity and imagination					
communication and leadership					
creating a common language					
setting common priorities					
creating three-dimensional, tangible objects					
analytical thinking					
being open to teamwork					
developing empathy skills					
ability to observe					
knowing end-user needs					
competition					
familiarity to real-life practices					
solving societal problems					
developing new knowledge and skills					
making sketches and setting up scenarios					
systemic thinking					
having the knowledge of contemporary issues					

expose to the industry & career area					
17. Other (Please specify):					

4.3   ANNEX-3: Results of the questionnaire

The following tables represent the results of the questionnaire sent to VET trainers about the Design Thinking (DT) concept, methodology, and implementation.

1.   Do you accept participating in this questionnaire considering the information provided above?

● I agree	71
● I do not agree	2

2.   How long have you been working in the teaching profession?

● 0-5 years	25
● 6-10 years	11
● 11-15 years	8
● 16-20 years	12
● Above 20 years	15

3.   How old are you?

● 18-20	1
● 21-29	14
● 30-39	24
● 40-49	18
● 50-59	7
● Above 60	7

4.   Gender

● Female	31
● Male	40
● Other	0
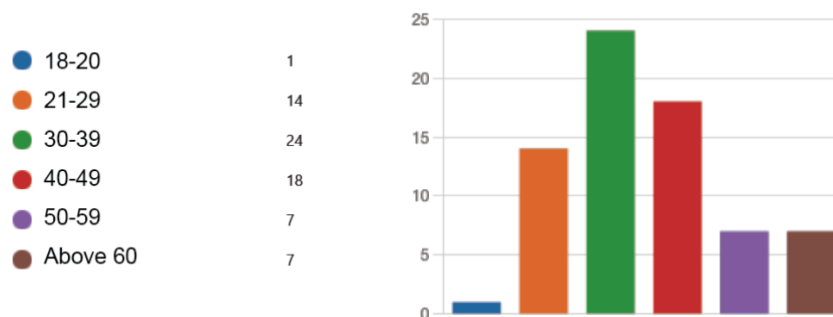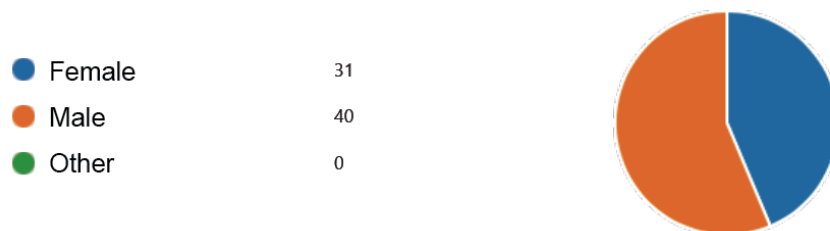
5. *In which country you are working?*

- ● Turkey — 45
- ● Germany — 21
- ● Italy — 5
- ● Other (Please specify: ...) — 0

6. *Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

Legend: ■ Strongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

- I can learn things but I cannot change my intellectual level.
- I can make changes to defined practices.
- I don't mind if I make mistakes while learning new methods.
- I question myself about what I learned after a discussion.
- I can transfer what I have learned through my experiences, feelings and attitudes.
- Sometimes I get angry when I receive comments about my work performance.
- I always try to turn constraints into opportunities.
- I am aware of how to transfer my new knowledge to my professional life.
- I question the reflections of my contributions in order to be able to do better.
- While learning new information, I realize how much I already know.
- I always appreciate feedback for professional development.
- I can understand how users feel intuitively
- I have self-esteem to share my ideas with my team.
- I am able to change my mind when learned a different information.

)0%   0%   100%

7. *Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

8. *Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

Legend: ■ Strongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

Statements:
- I am aware of the cultural values and religious beliefs of other cultures.
- I change my non-verbal behavior when it requires cross-cultural interaction.
- I can behave differently to suit different cross-cultural situations.
- I can design courses that integrate technology, information, and systems.
- I am able to create a reliable environment in the classroom.
- I am confident that I can socialize with local people even in a new culture.
- I can formulate in-depth discussion topics about content knowledge.
- I can facilitate students' online collaboration with appropriate tools.
- I give the instructions in a clear and understandable way.
- Teaching is a process not an outcome.

9. *Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

Legend: ■ Strongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

Statements:
- I welcome different kinds of feedback about my work.
- Trying new things is stressful for me, so I avoid it.
- I value when other people give me ideas that I can develop.
- I question myself about what I am learning through conversations.
- I question other people's solutions to have more variety to find better ones.
- Sometimes I can solve a problem without thinking about it.
- I believe it is necessary to create a new model for existing technology.
- I can formulate in-depth discussion topics about content knowledge.

10. *Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

■ Strongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

- I prefer to focus on the big picture and leave the details to others.
- I think nothing can make the world better.
- In problem solving process, I focus on the interactions.
- When solving problems, I optimize every part of the project.
- I analyze tasks broadly to find a solution that will have the greatest impact.
- I try to delegate the problem to find a quick solution.
- In order to solve the problem, it must first be framed.
- I always learn from my mistakes.
- It is necessary to have training to identify and formulate the methodology.
- I can create a fictional character to understand the user needs and visualize it.

11. *Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

■ Strongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

- I easily take initiative when noticing things.
- I easily collaborate with others.
- I cope with ambiguity and risk, also in situations when things do not go well.
- I learn from experience.
- I can motivate other and be an example myself.
- I plan and envision activities, and I am open to divert the plans when needed.
- I value ideas of the others too.
- I manage to spot opportunities also in unusual and negative things.
- Inner motivation drives me and I do not easily give up when things do not go well.
- Prototyping, iteration, experimentation, collaboration, and brainstorming are tools of Design Thinking Process.
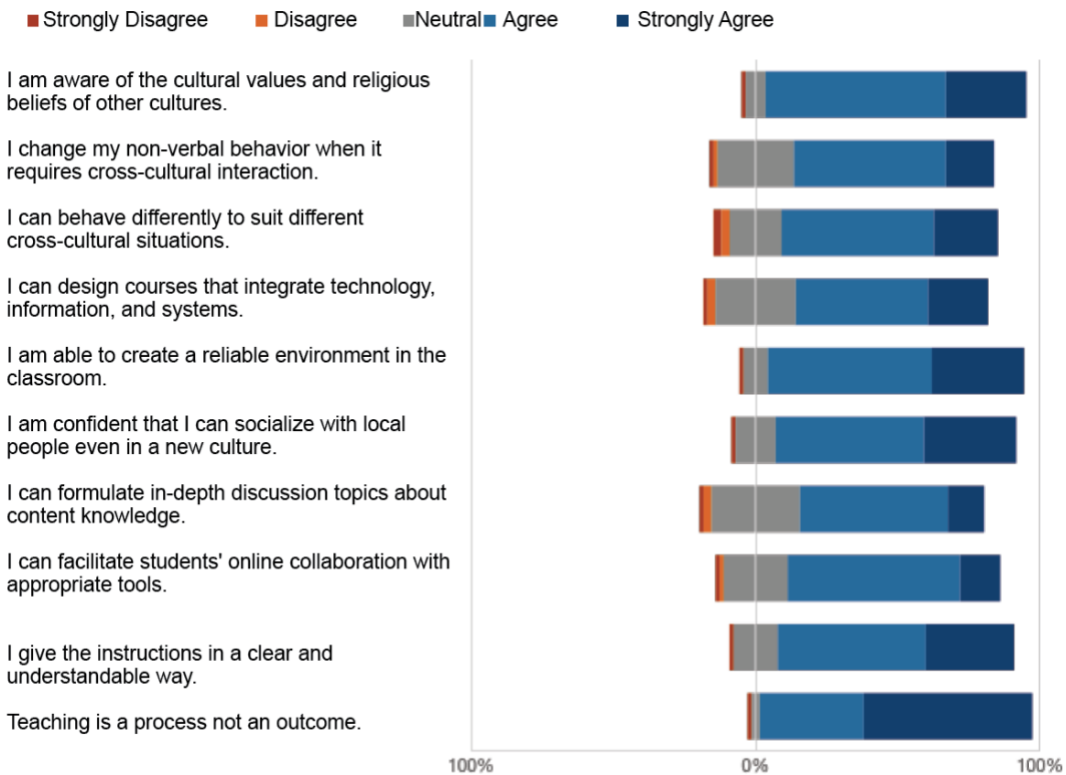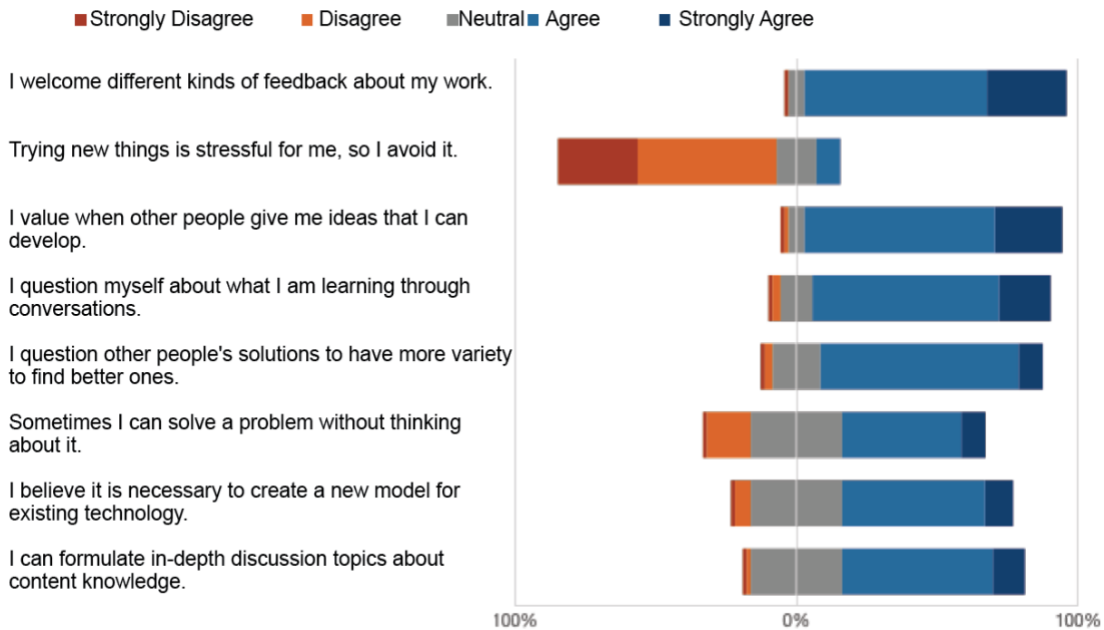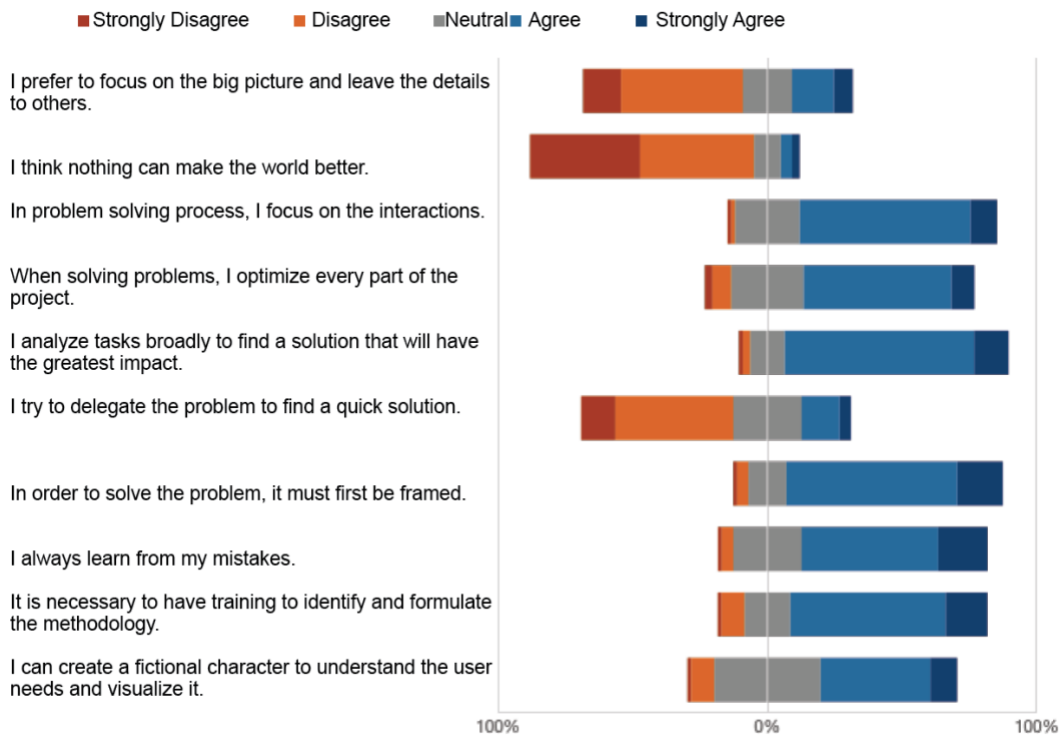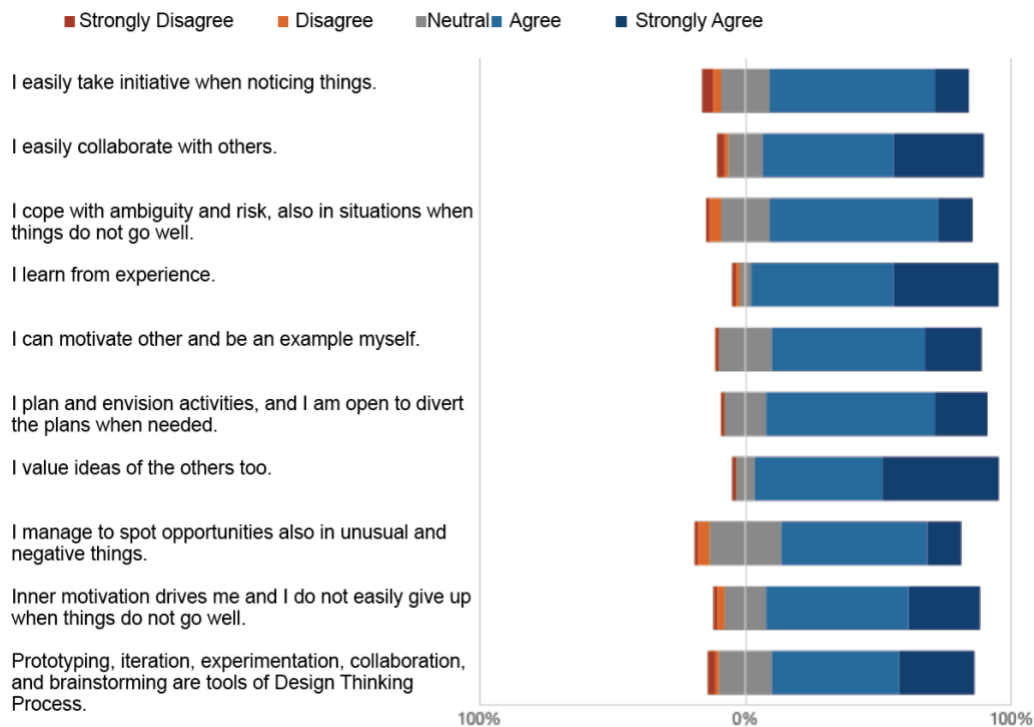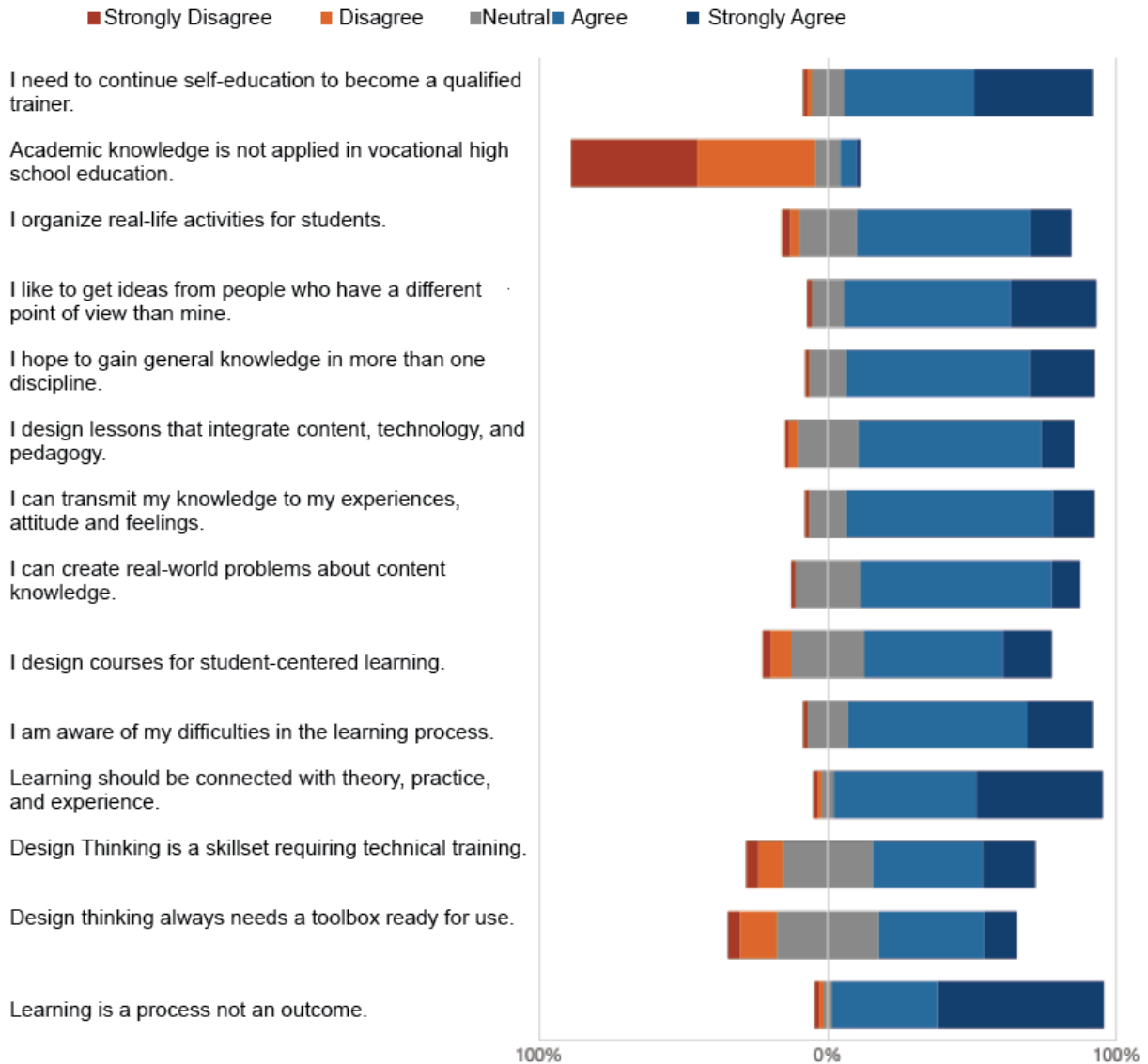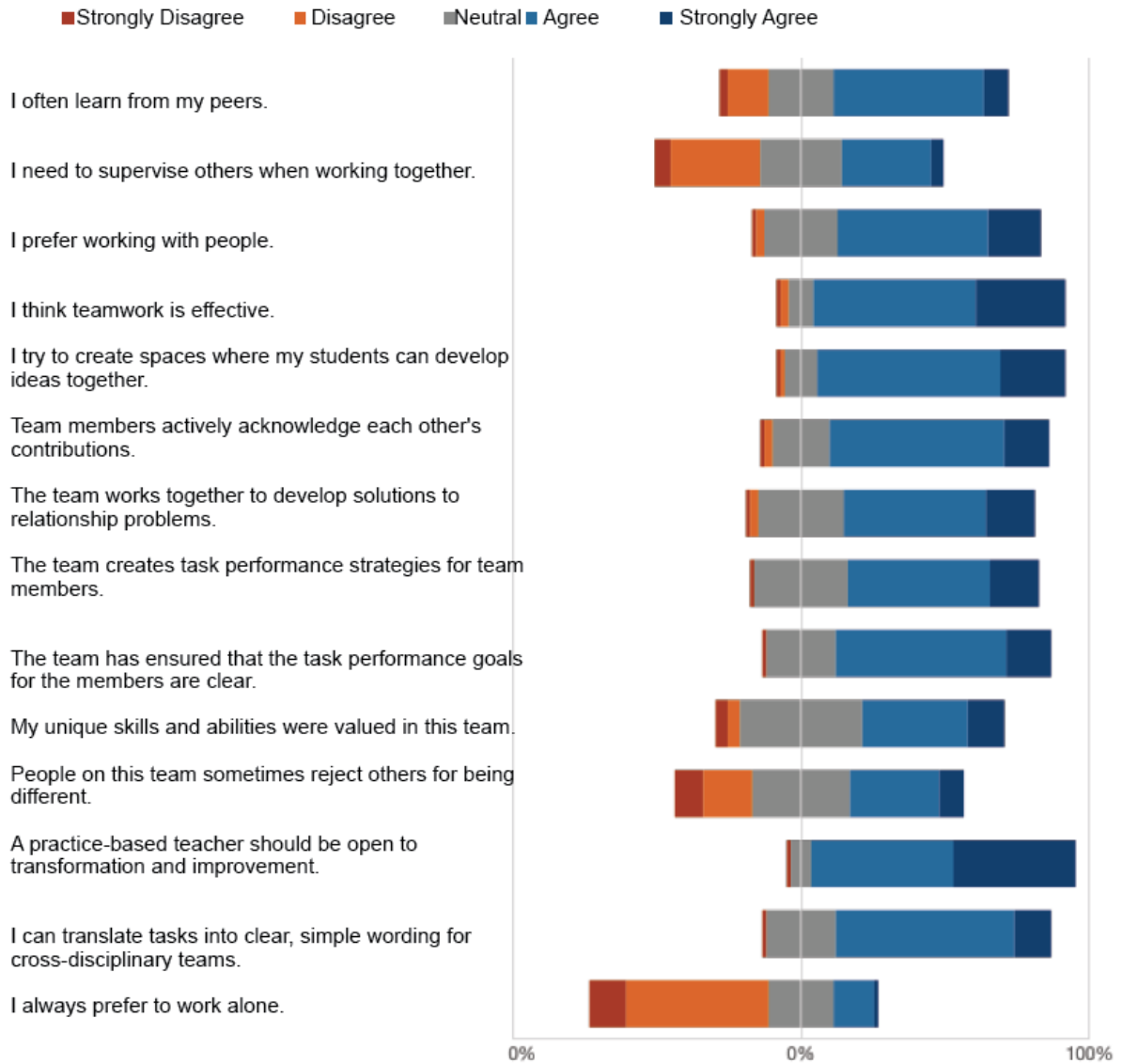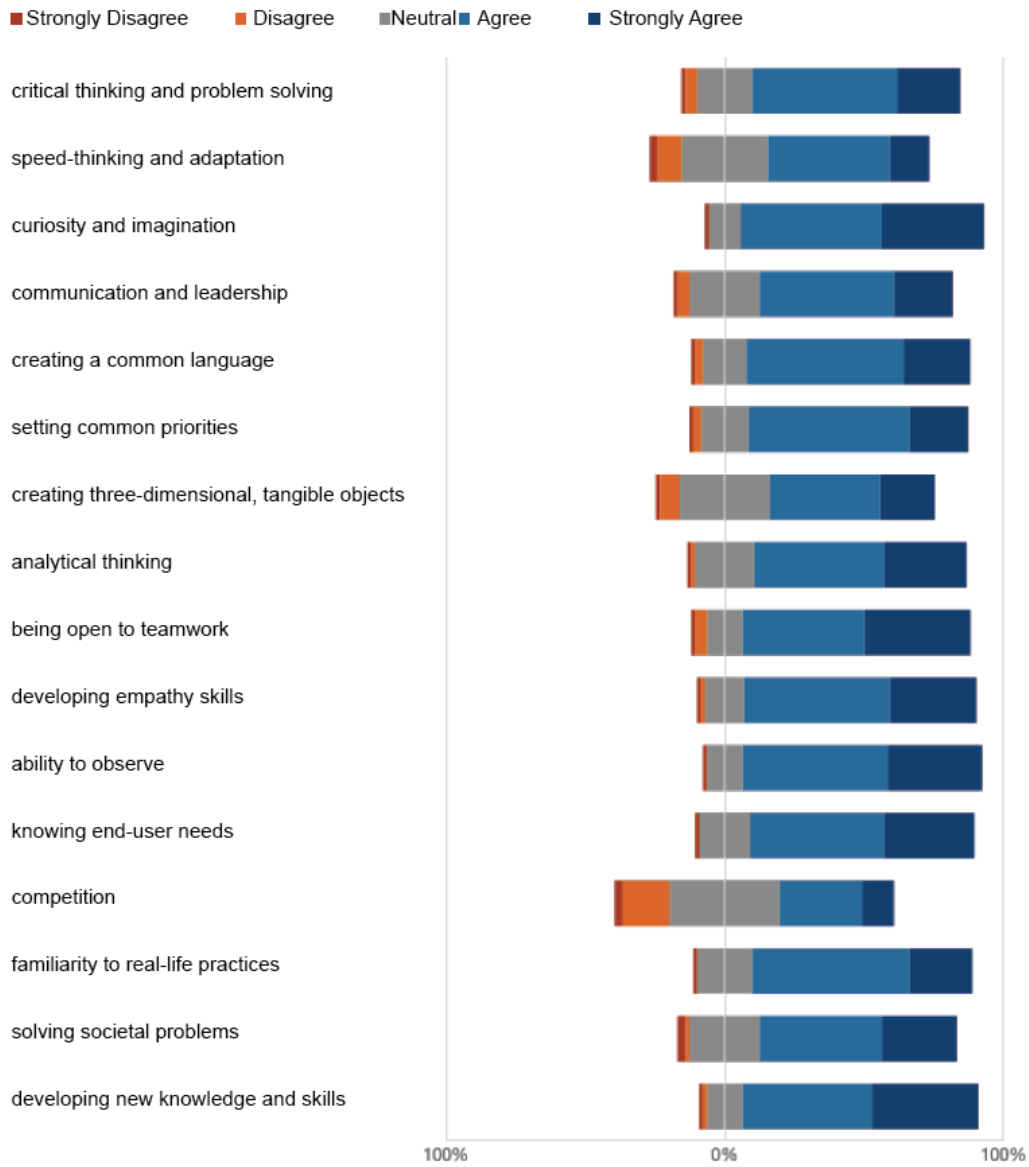
12. *Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

13. *Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

14. *Designerly Thinking means; in my opinion... Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*

Legend: ■ Strongly Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

Categories (top to bottom):
- critical thinking and problem solving
- speed-thinking and adaptation
- curiosity and imagination
- communication and leadership
- creating a common language
- setting common priorities
- creating three-dimensional, tangible objects
- analytical thinking
- being open to teamwork
- developing empathy skills
- ability to observe
- knowing end-user needs
- competition
- familiarity to real-life practices
- solving societal problems
- developing new knowledge and skills

Axis: 100% — 0% — 100%

15. *Designerly Thinking means; in my opinion…*

ID	Name	Answer	Language
1	anonymous	Use Visualization to face challenges[5]	Italian
2	anonymous	Observe with analytical awareness the functioning of things and the behavior of people, to know and understand their real needs[6]	Italian
3	anonymous	it is a problem-solving process[7]	Italian
4	anonymous	Imagination[8]	Turkish
5	anonymous	Changing challenging situations into manageable ones[9]	Turkish
6	anonymous	A person who thinks like a designer should have the reflex to "what kind of another form it can be" for every object he sees and to produce a solution to every problem right there.[10]	Turkish
7	anonymous	Thinking and applying new and effective[11]	Turkish
8	anonymous	It is to be imaginatively prosperous.[12]	Turkish
9	anonymous	creative thinking[13]	Turkish
10	anonymous	Finding answers to issues that currently exist and making life simpler[14]	Turkish
11	anonymous	Redefining problems and prototyping for testing is the process of coming up with innovative solutions.[15]	Turkish
12	anonymous	Contributing to the solution of real-life problems.[16]	Turkish
13	anonymous	By determining the needs and the sufficient possibilities, one can think like a designer.[17]	Turkish

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[5] In original language: Usare Visualizzazione per affrontare le sfide
[6] In original language: Osservare con consapevolezza analitica il funzionamento delle cose e il comportamento delle persone, per conoscerne e comprenderne i bisogni reali
[7] In original language: è un processo di problem solving
[8] In original language: Hayal Etmelidir
[9] In original language: Zorluklari kolaya çevirmektir.
[10] In original language: Tasarımcı gibi düşünen bir kişi, gördüğü her objeye "başka nasıl bir formda olabileceği" ve her probleme hemen orda bir çözüm üretme refleksine sahip olmalı
[11] In original language: Yeni ve etkili olanı düşünmek ve uygulamak
[12] In original language: Hayal gücünde zenginliğe sahip olmaktır.
[13] In original language: Yaratıcı düşünme
[14] In original language: Güncel sorunlara çözüm yolu üretmek, yaşamı daha kolaylaştırmak
[15] In original language: Redefining problems and prototyping for testing is the process of coming up with innovative solutions.
[16] In original language: Contributing to the solution of real-life problems
[17] In original language: İhtiyaçların belirlenmesi ve eldeki olanakların yeterli olması ile tasarımcı gibi düşünülebilir.

ID	Name	Answer	Language
14	anonymous	We should help the child draw the new line in a child's brain, not ourselves so that we can create new perspectives.[18]	Turkish
15	anonymous	be renewable[19]	Turkish
16	anonymous	being creative[20]	Turkish
17	anonymous	Having creative thoughts and experimenting with them[21]	Turkish
19	anonymous	Bringing imagination to reality[22]	Turkish
20	anonymous	Imagination, academic knowledge, rational perspective [23]	Turkish
21	anonymous	To build the project of our dreams[24]	Turkish

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[18] In original language: Bir çocuğun beyninde yeni çizgiyi biz değil çocuğun kendi çizgisini kendisi çizerken yardımcı olmalıyız böylelikle yeni görüş açıları oluşturabiliriz.
[19] In original language: yenilenebilir olma
[20] In original language: Yaratıcı olmak
[21] In original language: Fikirlerle oynayarak yaratıcı olmak
[22] In original language: Hayal gücünü gerçekle buluşturmak
[23] In original language: Hayal gücü akademik bilgi rasyonel bakış açısı
[24] In original language: Hayalimizde projeyi kurgulamaktır

16. *Designerly Thinking means; in my opinion, is useful for Vocational Education and Training for… Please score each of the questions on a scale from 1 to 5, where 1 represents "Strongly Disagree" and 5 "Strongly Agree".*
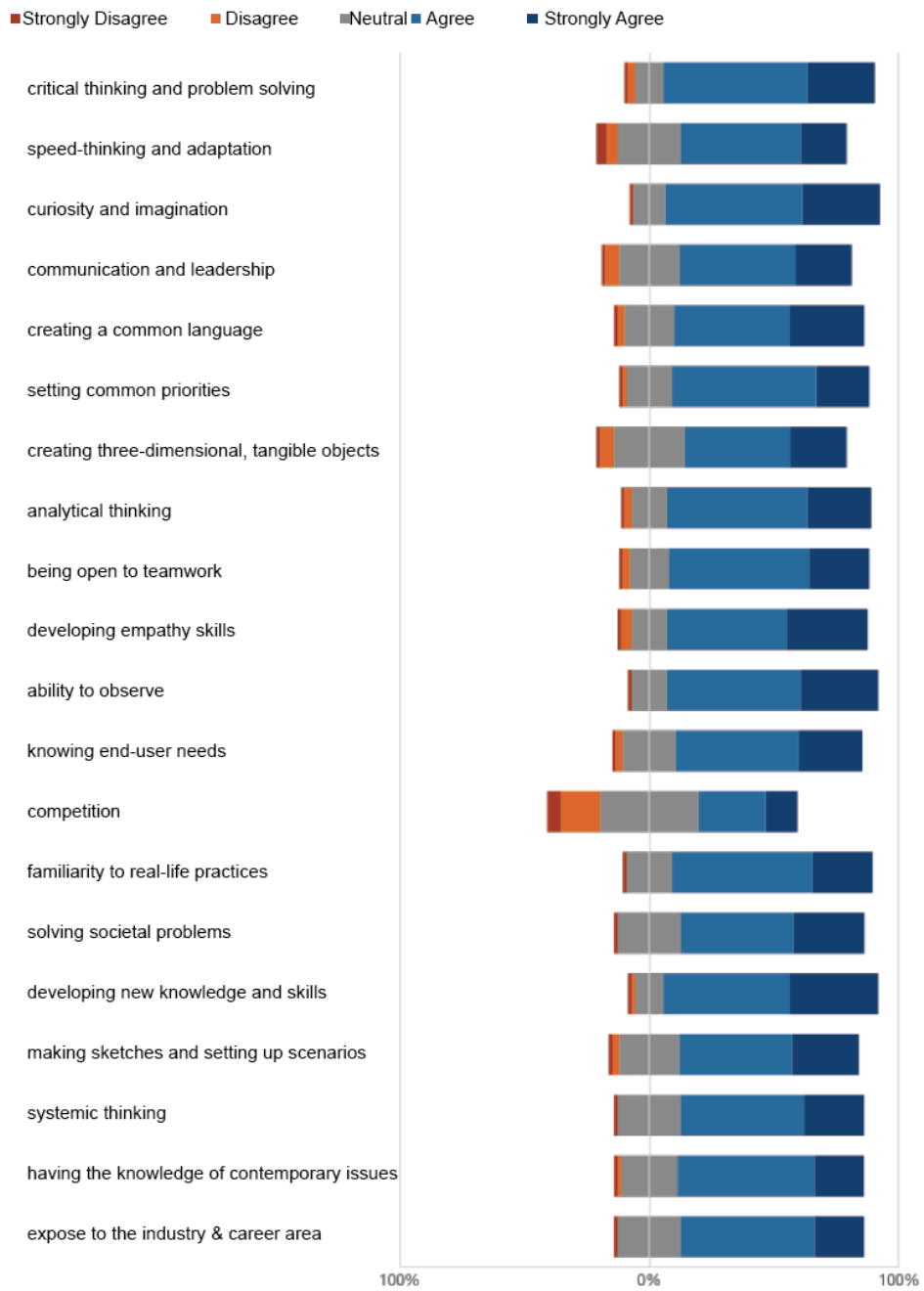
17. Designerly Thinking means; in my opinion, is useful for Vocational Education and Training for…

ID	Name	Answer	Language
1	anonymous	Visualize the problems and solutions[25]	Italian
2	anonymous	This is an important opportunity, a new approach to design thinking starting from man, a reversal of traditional business models, based mainly on business, to which man and technology were functional. The Design Thinking Mindset puts people and their needs at the center of the experience, making business and technologies functional for their achievement[26]	Italian
3	anonymous	Must learn by doing[27]	Turkish
4	anonymous	In all mechanical departments[28]	Turkish
5	anonymous	Someone should be able to realize how many designs that even affect how others live, change, direct, comfort or disturb us, and make designs suitable for their lifestyle.[29]	Turkish
7	anonymous	School projects, getting ready for life after school, putting what you learn to use in life and making it easier.[30]	Turkish
8	anonymous	It can be used in every branch of the vocational and technical field.[31]	Turkish
9	anonymous	Developing vehicle safety systems[32]	Turkish
10	anonymous	Anywhere it is required, it can be put to use.[33]	Turkish
11	anonymous	Technology[34]	Turkish
12	anonymous	Project[35]	Turkish

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[25] In original language: Visualizzare problemi e soluzioni

[26] In original language: Si tratta di una importante opportunità, un nuovo approccio del design thinking a partire dall'uomo, un capovolgimento dei modelli di business tradizionali, basati principalmente sul business, a cui l'uomo e la tecnologia risultavano funzionali. Il Design Thinking Mindset mette le persone e i loro bisogni al centro dell'esperienza, rendendo il business e le tecnologie funzionali al loro raggiungimento.

[27] In original language: Yaparak öğrenmelidir

[28] In original language: Makinasal tüm bölümlerde

[29] In original language: Birileri başkalarının nasıl yaşayacağına bile etki eden bircok tasarımın bizleri nasıl değiştirdiği, yönlendirdiği, rahat yada rahatsız ettiğini farkına varıp, kendi yaşam tarzına uygun tasarımlar yapabilmeli.

[30] In original language: Okulda projeler okul dışı ise hayata hazırlamak öğrendiklerini hayatla birleştirip kolaylaştırmak

[31] In original language: Mesleki ve Teknik alanın her branşında kullanılabilir.

[32] In original language: Araçların güvenlik sistemlerini geliştirmede

[33] In original language: İhtiyaç duyulan her türlü alanda kullanılabilir.

[34] In original language: Teknoloji

[35] In original language: Proje

ID	Name	Answer	Language
13	anonymous	Vocational education is important[36]	Turkish
15	anonymous	In every area where we want order[37]	Turkish
16	anonymous	Project development and concrete model creation[38]	Turkish

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[36] In original language: Mesleki eğitim önemlidir
[37] In original language: Disiplin olmasını istediğimiz her alanda
[38] In original language: Proje geliştirme ve somut model oluşturma