

Dual study courses in civil engineering education - an appropriate tool to improve sustainable economic growth in Greece

Emmanouil Vairaktaris† & Karl Mallwitz‡

Technological Education Institute of Piraeus, Athens, Greece†
Hochschule Wismar - University of Applied Sciences Technology Business and Design, Wismar, Germany‡

ABSTRACT: In this article, the authors describe dual study courses (DSC) in civil engineering education, already implemented successfully in Germany. They present the current situation in Greece considering the financial crisis with respect to unemployment and engineering education. The authors discuss the effects of implementing DSC in the Greek educational system with a focus on civil engineering education in the frame of the Bologna process. The main goal of this article is to discuss important aspects and components of dual study courses as part of a possible counteragent to deflate the present critical economic situation in Greece.

INTRODUCTION

Development at a technologically advanced level requires effective higher engineering education. It is well known that effective higher education (HE) should be accompanied by significant investments in educators, infrastructure, etc. Subsequently, the question that arises is what happens in this case with countries in the middle of severe economic crisis, e.g. Greece? The answer is that it is important to create or adjust and install already successful new educational models, such as dual study courses, which have been proved to be effective in higher engineering education in Germany.

One reason for the installation of DSC in Germany was to increase the output of universities in terms of graduates, also taking into consideration the demographic prognosis, which is in stark contrast to the strong demand for engineers. In Greece, the case is completely different; Greece is educating more engineers than needed for the country's development. Nevertheless, the Greek mentality promotes higher education and separates it from employment, in general.

At the same time, Greece is facing a significant demand for technicians and employees, in general educated within secondary and post-secondary education. Furthermore, unemployment among young people is over 50%. Following the previous considerations, and with the financial deficit of families to invest in the post-secondary and tertiary education of their children, the authors discuss the application of DSC - already well implemented in Germany - in Greek tertiary education.

Dual study programmes in Germany [1][2] comprise both Bachelor's degrees and training qualifications in a fixed time frame, which are offered mostly by universities of applied sciences, but also by universities [1][3]. The main task of dual study courses is to improve the employability of young people and to increase the output of universities in terms of graduates, as Germany with a tertiary level graduation rate of 30% is still below the OECD average of 39% [4].

In addition, dual study courses can be regarded as an effective tool in reducing public funding in HE, due to private funding by companies utilising this educational option. The question, however, is to what extent dual study courses are to become a success story for all states in all engineering disciplines, remains to be seen, especially, for countries such as Greece that are in the middle of severe financial and social crises.

COMPONENTS OF DUAL STUDY PROGRAMMES

Dual study courses in the way they are now running had their beginning in the early 1970s in the so-called *Berufsakademie* in Germany that can be translated as *university of cooperative education*. This type of university,

meanwhile legally equivalent to universities of applied sciences, often had been part of a large company. Universities of cooperative education have their seeds in the Federal State of Baden-Württemberg as one of the federal states noted for industry on a technologically advanced level. The driving force to install this type of educational tool was to improve the employability of young people by incorporating them in the working environment of companies parallel to their theoretical tuition.

Another motivation was industry's evolving demand for highly skilled employees. As a result, the alumni were by far more *job ready* for the corresponding companies in comparison with standard alumni from universities or universities of applied sciences. Graduates of the latter needed a period of vocational adjustment, whereas the alumni of cooperative educational programmes were already incorporated to perform highly specialised activities in the field of e.g. manufacturing and production planning. This idea of creating customised highly specialised and highly qualified employees was adopted and introduced over the last 10 years in the frame of general skills shortage in Germany throughout the country.

According to the present situation in Germany, Figure 1 shows the degrees according to the Bologna process, comprising traditional German degrees as well. This figure shows, that the apprenticeship in a dual study course is independent of paths to advanced studies. Bachelor degree students from universities can change to Master's programmes offered by universities of applied sciences and *vice versa*. Different paths to doctorates and research are possible, and the university path is no longer obligatory, as it was in former times, whereas universities are still entitled to confer doctor degrees.

As access requirements for universities of applied sciences are no longer strictly bound to general higher education entrance qualifications or subject to restricted higher education qualifications, applicants without higher education entrance qualification for studies at universities of applied sciences can pass an admission examination after finishing vocational training and having at least three years of professional work afterwards. Thus, the educational system has become somewhat pervasive for those young people with secondary vocational education, as universities of applied sciences enable a smooth transition between secondary and tertiary education. The access requirements can differ in detail between the 16 federal states due to the federal educational system in the German state with self-governed universities.

Dual studies, with a usual duration of 4-4.5 years, is more time consuming in comparison with conventional Bachelor courses with a duration of 3-3.5 years, but shorter in comparison with completing apprenticeship and academic studies, sequentially. Regarding the two certificates, the time saving by undertaking dual study courses concerning civil engineering is about two years.

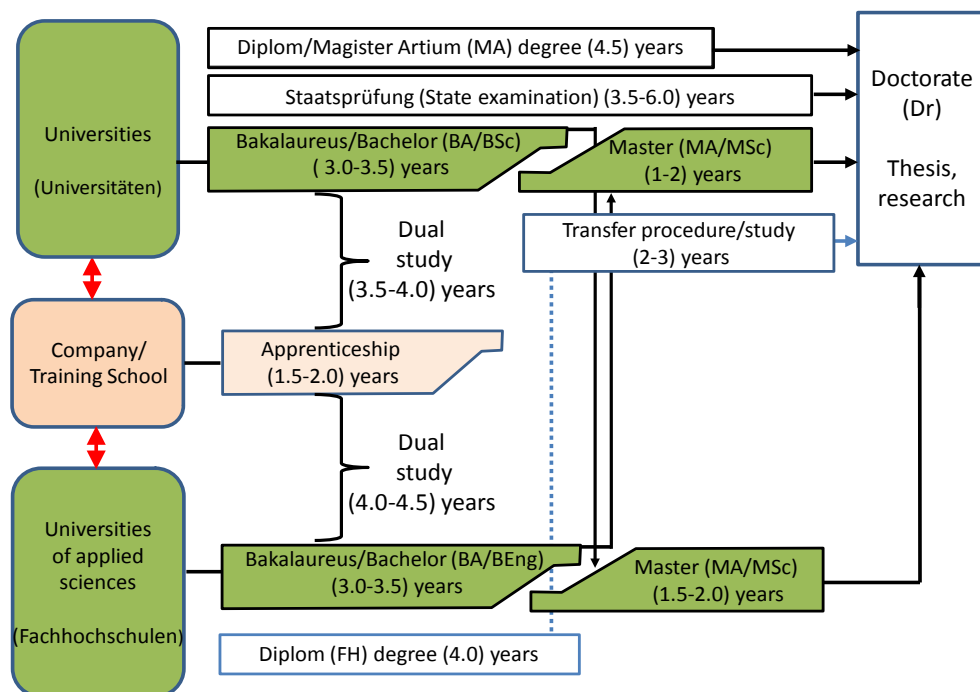


Figure 1: Dual study courses in the frame of institutions, degrees of German higher education.

It is important to note that dual study courses in Germany do not result in an equal qualification to the so-called dual study courses in many other countries. With respect to engineering education, the two-fold qualification achieved in German dual study courses consist on the one hand of the Bachelor degree - on the other hand of a *Facharbeiterbrief* that can be translated in *craft certificate* or in other cases furthermore of a *Gesellenbrief* that can be translated as *journeyman's certificate*. The latter certificates do not equal those in other countries, as the standards for an

apprenticeship as *skilled worker* or an apprenticeship as *journeyman* differ, and furthermore, what seems to be more important, in many countries a final examination at the chamber of commerce or the chamber of crafts does not exist. The chamber of commerce and the chamber of crafts are independent institutions, so uncoupled from the company/training school, as well as uncoupled from the university/university of cooperative education.

The schedules of dual study courses differ in extent and degree of integrated apprenticeship, dependent on the cooperation contract between the university and the company or training school. Therefore, they cannot be generalised. Figure 2 shows possible modes of implementation of dual study courses as carried through in one or the other case. The modes of study show that in any case students have to be flexible concerning the study programme due to the changing locations of study.

Each participant of a dual study course generally is running through 3 stages.

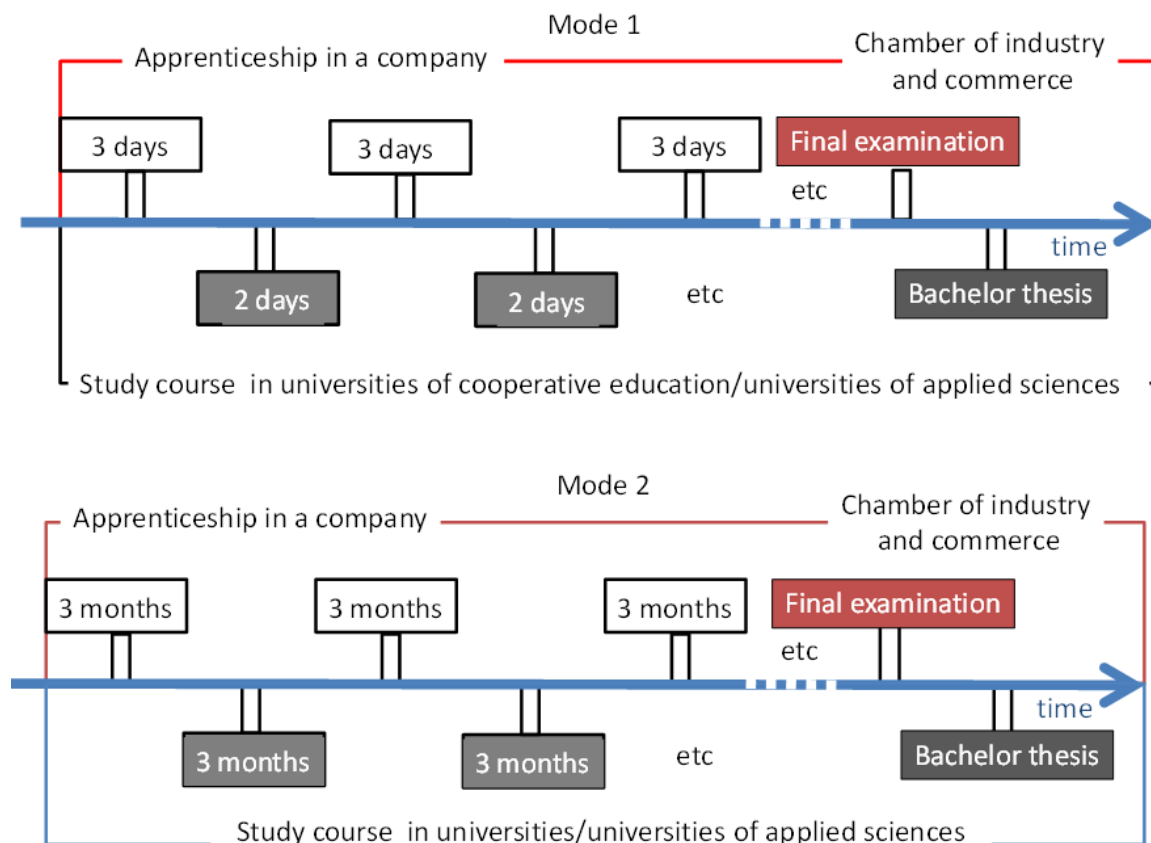


Figure 2: Mode 1 and Mode 2 of the implementation of dual study courses in engineering education.

First stage: the student is mainly involved with the apprenticeship, either in a company or in a training school. The regular attendance at university can be one or two days a week or totally omitted. This stage takes about 1 to 1.5 years. The study mode shown in the upper part of Figure 2 (Mode 1) allows a tight combination of theoretical content of teaching and practical implementation.

Second stage: studies and apprenticeship alternate about 1.5 to 2.0 years, adjusted to the semester breaks (see Figure 2, Mode 2). Normally, this stage is completed by a final examination at the chamber of industry and commerce as a skilled engineering worker, according to the chosen training qualification.

Third stage: studies take place in the university exclusively. This stage lasts about 1.5 to 2.5 years and is completed by a Bachelor thesis.

As noted, dual study courses in civil engineering either in universities or in universities of applied sciences take 4 to 4.5 years. Most of students studying in dual study course programmes are granted by industry. As a consequence, a student has to manage both qualifications in a relatively short and condensed time frame. Therefore, successful completion of a dual study course is acknowledged by industry as a qualification bonus for applying students as it is a proof of self-discipline and self-managing ability - very important skills for employability.

Dual study courses are in accordance with the Bologna process, because the Bachelor degree courses offered within dual study courses do not differ from normal Bachelor degrees (this holds throughout Europe). Uncoupled from this, in

Germany, the apprenticeships at training schools or companies are in accordance to the educational standards required by the chamber of commerce or chamber of crafts.

EDUCATION IN GREECE (WITH RESPECT TO THE CRISIS)

Post-secondary Non-tertiary Education in Greece

Post-secondary non-tertiary education is operated through vocational training institutes (IEK) [5]; they constitute the main means to achieve the aims set by the Vocational Education and Training Organisation (OEEK). Their graduates can receive professional rights enabling access to the labour market in both the public and the private sectors. Vocational training institutes (IEK) fall under post-compulsory secondary education and offer formal yet *unclassified* education since they enrol both graduates from lower secondary schools and graduates from all types of upper secondary schools, according to the specialties offered [5].

There is no direct access to tertiary education and OEEK graduates can enter higher education (AEI, Anotata Ekpaideftika Idrimata and ATEI, Anotato Technologiko Ekpaideftiko Idryma), only by passing national level examinations. IEK graduates who have not yet sat for examinations for vocational training certification are entitled to take a six-month apprenticeship. The time spent on this apprenticeship is recognised as prior experience for granting a license to practice a trade. The apprenticeship, supervised by a coordinator, may take place in the public sector, in legal entities of public or private law or in private companies. Apprenticeship is a measure that aims to help graduates get job positions corresponding to their qualifications, reduce unemployment and improve the quality of the provided services [5]. The private sector is involved in vocational training as it is with apprenticeship. Employees, in general, are not involved in the development of curricula used in vocational education.

Tertiary Education in Greece

Tertiary education in Greece is public and funded primarily by the state. It comprises two parallel sectors: a) the university sector, which includes universities; technical universities and the School of Fine Arts; and b) the technological sector, which includes (higher) technological education institutions (TEIs), and the School of Pedagogical and Technological Education (ASPETE). Admission of students to the above institutions depends on their performance at nation-wide examinations taking place in the 3rd grade of the upper secondary school. Tertiary education in Greece is provided free of charge (exceptions apply with regard to specific postgraduate programmes, the Hellenic Open University and the International Hellenic University).

While the first sector is similar to those of other European and international education systems, the higher technological education is mainly provided by the TEIs, which are governed by the same constitutional provisions applicable to universities, as far as their organisation and operation are concerned. The private sector is involved in the tertiary education in ways other than the six-month apprenticeships of the TEI students, provided at the end of their studies. Employees, in general, are not involved in the development of curricula used in tertiary education.

Current Debates and Perspectives on Vocational and Higher Education in Greece

The reform of Greek vocational education (VE) has been given special attention in recent years [5]. Some of the more important aspects of this ongoing effort, with the major aim to upgrade VE include: a) the consolidation of special vocationally oriented secondary education units; b) the facilitation of the access to post-secondary non-tertiary and tertiary education for VE graduates; and c) the substantial regulatory and institutional reform of higher education. The first two points are directed related to the DSC. The relation of the later one with the DSC is explained below.

One of the main challenges in Greek HE is the establishment of equitable, widely accessible academic institutions that will be accountable to the state and society at large. Most of the parties involved are focussed on reforming admission criteria and procedures in order to increase the number of available options for young people and vulnerable groups (persons with special needs, lower socio-economic backgrounds) for entering HE. The main objective of a special committee focussed on this issue is the introduction of flexible higher education entry routes, by reforming the ineffective existing admissions system. Another significant point is the need for increased funding, which should be provided for measures, such as the support of liaison offices and student work placements.

Considering all the above mentioned facts concerning the Greek education (GE), it can be observed that:

- GE1 There is no interaction between the higher education and the private sector except for apprentices included in the TEI curricula. Furthermore, there is no connection between higher education and the labour market. There is no interaction between vocational and the higher education, i.e. they are connected in the same way as in typical education.
- GE2 There is no connection and interaction between vocational education and the private sector of the apprentices included in the TEI curricula. Furthermore, there is no connection between the higher education and the labour market.

- GE3 No specific funding exists for potential students of lower socio-economic backgrounds. Greek HE is funded only by the state. The private sector is not involved in the funding of HE in Greece.
- GE4 Following points GE4 and GE5, it can be easily observed that students with low financial background are working in part time (or even full time) positions, and usually in jobs which are, in general, not related to their studies. Subsequently, most of the time the same students continue to work in non-related to their education jobs, a fact that increases unemployment in Greece.

In the same time, Greek educational policies (GP) are focusing on:

- GP1 Widening and changing in a more flexible way access to tertiary education, in general, and also for the VE graduates.
- GP2 Establishment of special vocational education units.
- GP3 Facilitation of inter-mobility between vocational and post-secondary non-tertiary and tertiary education.
- GP4 Increase access to tertiary education for vulnerable groups.
- GP5 Increase the role of HE institutions globally and, especially, their international cooperation.
- GP6 Increase funding for higher education.

IMPLEMENTATION OF DUAL STUDY PROGRAMMES/COURSES IN GREECE - IS THERE AN ANSWER IN EDUCATION TO THE GREEK FINANCIAL CRISIS?

Regarding the above listed educational and political facts, the authors' view is that GE1 is the governing point. Against this background, the authors provide several points considering the implementation of DSC both in vocational and tertiary education. Starting from vocational education and training (VET), some first comments on the importance of VET on employment are stated by Keep [6].

There is a growing interest in models of dual and alternating initial vocational education and training in view of the high youth unemployment rates in the southern EU member states [7][8]; in Greece and Spain, the unemployment rate for young people is over 50 percent [9]. Spöttl and Windelband also state that the VET system should be reformed with the *dual* system as a pivotal point [7]. As the dual system in general, the authors of this work are meaning the involvement of education and apprentice in the same course or curriculum. As mentioned by Keep [6], by implementing DSC both in vocational and tertiary education, the transition between school and employment can be improved because combining theoretical reflection in vocational schools with practical in-company experience in the initial stages of the DSC: a) ensures that the businesses will have skilled workers; and b) facilitates the young people's transition into the labour market, due to their twofold qualification after tertiary education [9].

The importance of apprenticeships rather than simply vocational training and practical learning is stated by Ryan [10]. The author suggest that it would be desirable for apprentices to be of a status that shares particular features with those of the full-time student and the regular employee, while being at the same time clearly separated from both. Furthermore, workplace-based training has been praised for its effectiveness in smoothing the school to work transition [11]. Apprentices have been shown to have a higher employability rate as compared with other secondary-school graduates. The results of this work suggest that it is not the increased specific skills of apprentices, but rather the increased screening and maybe the signalling effect of apprenticeship training that improves the school to work transition. As stated by Busemeyer and Trampusch, vocational training, known as collective skill formation systems, is more effective if it is collectively organised by businesses and unions (in the sense of firm-based apprenticeships) with state support and cooperation in execution, finance and monitoring [12].

Another study showed that signs of unemployment *crisis* may be resolved by establishing more institutional forms of apprenticeship [13]. In the same vein, a two-year apprenticeship with Federal VET Certificate was established in Switzerland in 2002, which aimed at increasing the employability of low-achieving school leavers [14][15]. The findings confirm that the new apprenticeship offers favourable learning opportunities that foster employability and upward mobility after graduation. However, the findings also indicate limitations of the two-year apprenticeship, such as the least successful learners can only profit from the new form of apprenticeship to a certain degree [16]. Note that all the above mentioned statements in this paragraph relate to VET and not HE. Nevertheless, since DSC includes VET and apprentices, the above are already an advantage for a DSC graduate, with respect to graduates of existing HE study programmes.

As far as the implementation of DSC in secondary education is concerned, experience shows that Germany's dual system is suitable as a model but not as a blueprint. This is why the dual vocational training system has been broken down into eleven components that can be viewed individually [6]. The adaptation of the system is beyond the limits of this article; nevertheless, it should be considered in following research work. How is the dual system financed? How can theory and practical training be combined in a meaningful way? How are examinations conducted? The study extends beyond the scope of the German system, to the international level. Other countries also have vocational training systems with dual elements that can equally be taken into consideration. A very important aspect for the implementation of DSC is the involvement of the labour market. The authors' view is that since the involvement of the labour market is

absolutely necessary for the implementation of the DSC; it should be involved in all the stages of the whole project, even in curriculum development.

CONCLUSIONS - SUGGESTIONS

Dual study courses prove to be an excellent opportunity to those students who have simultaneously a strong interest in the theoretical approach, as well as a strong interest in the practical approach in engineering science and practice. All in all, students have the best from dual study courses, as well as companies who have an excellent chance to handpick highly skilled employees. On the other hand, DSC is not a miracle cure to solve all problems. Against the background of an increasing gap between rich and poor in Greece and elsewhere in Europe, the completion of dual study courses for young people turns out to be a chance to provide a basis for the future, flexible enough to cope with the requirements and challenges of economy in a changing world.

What also seems to be important, implementation of dual study courses is a chance to provide an educational basis that is independent from the parents' income following the principle of equal opportunities for everybody. Simultaneously, there is a need of a common educational base with generally binding quality criteria. So, quality assurance is an important issue that has to be strictly bound to quality management by the state only.

All in all, the principle of equal opportunities combined with quality assurance with a strong focus on skilled manual jobs is an inalienable prerequisite for dual study courses to become a story of success in Greece. The fulfilment of these prerequisites provides a basis for comparability with relevant data throughout Europe. Thus, the comparability will contribute to the competitiveness of skilled crafts and trades, as well as to the industry of Greece. Furthermore, comparability within reference standards in Europe will contribute to an increase of confidence and reliability in general and, therefore, will decrease emigration or migration of young people as well as brain drain.

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