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Setting Up An Engineering "Pilot Study Program" In E-Mobility" For International Students: Issues And Solutions

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SETTING UP AN ENGINEERING "PILOT STUDY PROGRAM" IN E-MOBILITY FOR INTERNATIONAL STUDENTS: ISSUES AND SOLUTIONS

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ABSTRACT

This practice paper presents the issues and solutions in introducing a new international engineering study program at a German university that attracts especially non-European students. The master's program electromobility with the four majors Artificial Intelligence and Autonomous Driving, Connectivity, E-Powertrain and Sustainable Mobility & Production Technology was newly introduced in the winter semester 2022/23. It combines the expertise of all engineering departments like mechanical engineering, electrical engineering, computer science and artificial intelligence, materials science and chemical engineering to offer a

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modern and attractive engineering education for sustainability in an ecologic and economic important field. The high amount of applications with more than 1600 applicants per semester shows the high visibility and attraction of this study program. As the international master's program is offered in English language, especially students e.g. from India, Pakistan or Bangladesh who already have a bachelor's degree taught in English language are interested in this program. The selection of future students out of a high number of applications is challenging, while this process has to be completed in a very short period of time. With this high number of international students, further issues occur regarding visa application, housing and other organizational aspects. Practical solutions are presented in this paper that lead to transferable recommendations for the future design of such large-scale study programs for other universities.

1 INTRODUCTION

1.1 Current trends for the future of mobility

One of the greatest challenges in this century is the global climate change that affects people and their environment all around the world to varying degrees and demands new research projects from various disciplines. E-mobility is a key technology for climate-friendly mobility. The discussion about banning internal combustion engines in the European Union by 2035 shows how important these alternative drives will be for the future of mobility. Along with research, education must also be adapted to changing issues. The study program e-mobility matches these current trends and was developed as an international "pilot study program" starting in winter semester 2022/23. The international orientation may lead to enhanced cooperation between different nations. Furthermore, international students are welcome to stay and work in Germany after they will have finished their studies. This may counteract the shortage of skilled workers that employers are facing in the German industry.

1.2 Setting up a new international pilot study program in e-mobility

A survey of common literature on this topic lead to a study of the global management consulting firm McKinsey & Company [1] that identified four trends in the field of mobility. These are Autonomous driving, Connected cars, Electrified vehicles and Shared mobility. Although e-mobility is a megatrend, dedicated study programs "e-mobility" (not just "automotive engineering" with a major in electrical driving) are relatively rare at German universities. The homepage "studienwahl.de" is the official information portal of the Federal Republic of Germany for study programs. It lists only about 10 universities in Germany with a dedicated e-mobility master's program and most of them are in German language [2]. Considering the curricula and competence profiles of these study programs and especially based on the McKinsey study [1], the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) decided to develop its new study program e-mobility with the four majors Artificial Intelligence (AI) & Autonomous Driving, Connectivity, E-Powertrain and Sustainable Mobility & Production Technology [3]. Referring to the existing curricula in e-mobility in Germany, the study program also comprises competencies in the field of mechanical and automotive engineering, electrical engineering, computer science, artificial intelligence and materials science in fundamental courses. As e-mobility is an interdisciplinary field, all departments from the faculty of engineering are involved.

2 METHODOLOGY

The methodology presented in this paper consists of the following steps:

1. Conception and implementation of the new pilot study program e-mobility
2. Identifying common issues of the first two student cohorts
(winter semester 2022/23 and summer semester 2023)
3. Structuring of the common issues in research questions (RQ)
4. Answering the research questions with transferable solutions

The following research questions according to step 3 were derived from the issues to structure the elaborated knowledge. This leads to solutions that are transferable to similar problems at other universities within and beyond the SEFI community:

- RQ1: How can the popularity for newly established international study programs be increased worldwide?
- RQ2: What evaluation options are suitable for admission in the case of large application numbers?
- RQ3: Which issues occur especially for non-EU-students and how can you solve them?

3 RESULTS: ISSUES AND SOLUTIONS

3.1 Gaining visibility and attractiveness (RQ1)

While the bachelor program is offered in German language, the international master's program was designed bilingual, so students can choose to study in German or in English language. Due to the offered program in English, international students were expected to be attracted, here especially applicants who already studied in English during their bachelor's degree. These students are typically from countries like India, Pakistan or Bangladesh and usually have a very good knowledge of English. When opening the application phase for the new study program in spring/summer 2022, the FAU did not expect more than 300 applications for the international master's program in the first semester. From experiences with new study programs in German language it was known that it takes up to 1-2 years, until these new study programs are renowned in the target group. Beside information about the new study program at the university study homepages, the following measures were conducted to increase popularity:

- "Premium entry in International programs in Germany" was offered at DAAD (German Academic Exchange Service) [4].
- The structure of the study program with some majors in mechanical engineering, electrical engineering or in AI opened up a wide field of applications from bachelor graduates, mostly in mechanical, electrical, vehicle or automotive engineering.
- A study start is offered not only once a year, but in every semester (see also Table 1).

Fig. 1 shows the development of numbers of applications for the international master's program. The mentioned measures were suitable to gain visibility and attractiveness. Especially, the DAAD premium entry was very successful to attract students. All these measures resulted in a high number of applications in the first year that raised even more in the following semesters. In the upcoming winter semester 2023/24 there are even more applications expected. Currently, an average of 20% of the applicants get an admission to the master's program. In the past semesters, most of the admitted applicants decided to start their studies resulting in high numbers of freshmen of about 200-450.

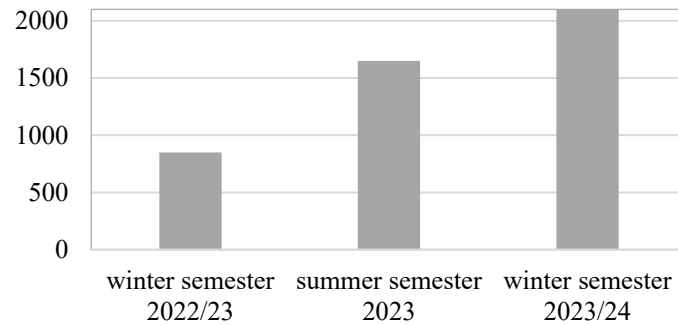


Fig. 1. Development of numbers of applications from winter semester 2022/23 to winter semester 2023/24

3.2 Suitable evaluation options for admission in case of large application numbers (RQ2)

When the new study program was introduced, there was a high level of uncertainty about the number of prospective applicants. Furthermore, it was not clear, how many of the admitted applicants would enroll in the program. The transition from paper applications to online applications was performed at the university during the Covid pandemic, resulting in a university-wide doubling of applications for international study programs.

Due to the high number of applications, individual interviews could not be conducted. Furthermore, tests in presence could not be offered due to the high percentage of non-EU-applicants. Therefore, the evaluation process is performed mainly based on the submitted documents. Since the applicants not only come from different countries and universities but also apply with different bachelor's degrees e.g. in mechanical or electrical engineering, a suitable evaluation approach has to be set up to compare the qualifications and achievements of the applicants. Therefore, the evaluation committee had to deal with the following aspects:

- Comparison of achieved modules that are relevant for the master's program with the bachelor program e-mobility of FAU
- Conversion of grades from other countries to the German university grading system
- Language certificates and proficiency tests to assure good knowledge in English (Level C1 in the Common European Framework of Reference (CEFR))
- Admission tests (open book or proctored)
- International comparisons and rankings to evaluate degrees from different universities and countries
- Further qualifications e.g. work experiences, motivation
- Examination of admission with conditional modules that must be completed as part of the master's program

The evaluation procedure comprises a formal check by the master's office of FAU and a professional review by the evaluation committee of the study program at the department. The application and evaluation procedure is shown in Fig. 2, starting with the preparation and submission of the application by the applicant.

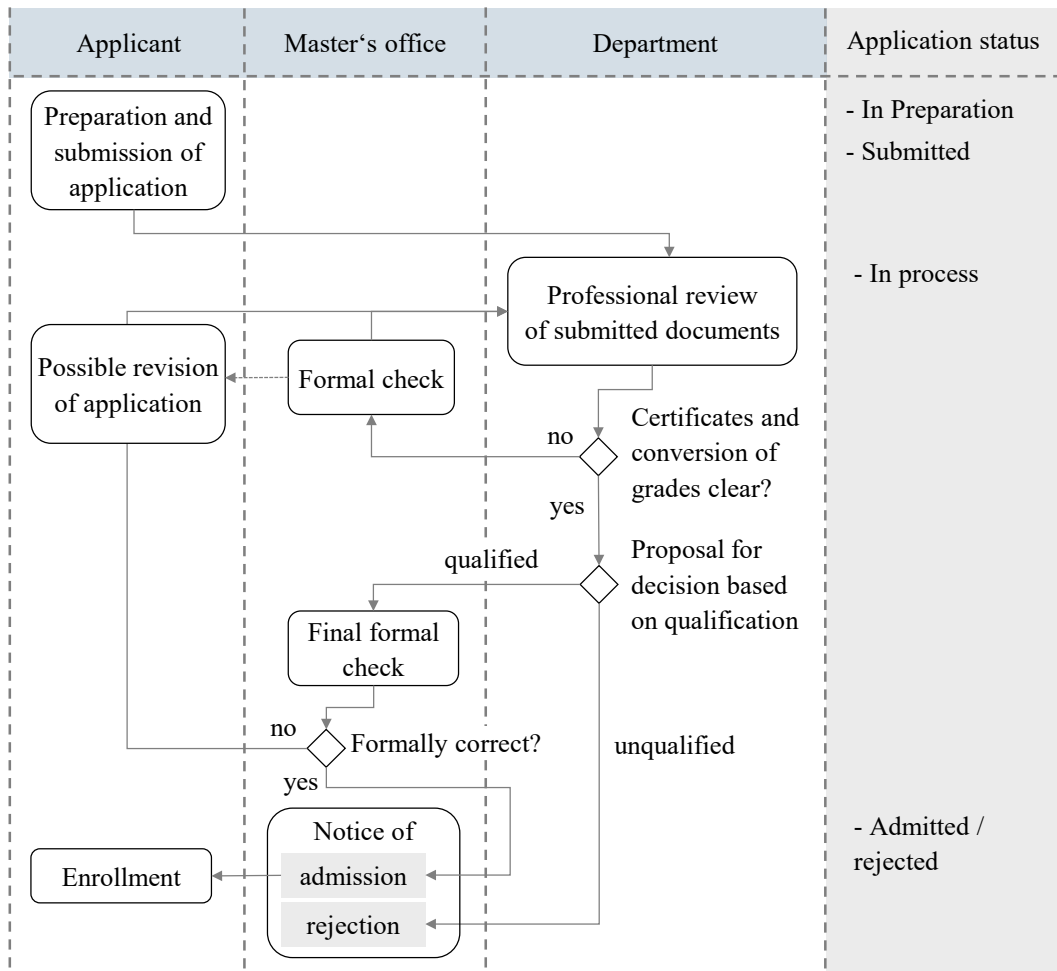


Fig. 2: Application and evaluation process for the international master's program

The application numbers are very high, most of the applicants (>85%) submit their application formally correctly and an average of only about 20% of the applicants currently are accepted in the professional review due to the high requirements for study entry. Therefore, the professional review is performed in the first evaluation step **before** the formal review by the university-wide master's office. Only in case of unclear formal issues, e.g. unclear submitted certificates or false conversion of grades, a request for formal check is sent to the master's office as first step of the evaluation. In that case, the formal check is done already at this point in the evaluation process to enable appropriate professional evaluation by the committee at the department. After the professional review, the evaluation committee makes a proposal for decision. If the evaluation shows that the applicant is not qualified, there will be a rejection and no further formal checking is necessary. If the committee decides that the applicant is qualified for the master's degree, there is a final formal

check before the applicant will receive the notice of admission and will then be able to enroll in the study program.

The advantage of this procedure is that the master's office does not need to check every application formally. The formal check is only done after a request or for those applicants who are qualified based on the evaluation at the department. Especially in the case of high number of applications, this is an appropriate way to relieve the master's office.

3.3 Issues and solutions that occur especially for non-EU-students (RQ3)

Major problems occurred especially for non-EU-students regarding the application for visa and entry to Germany. It has to be considered that applicants often have to wait for several months to get an appointment at their embassies. In the first semesters, many admissions were issued at too short notice. Therefore, the application period will start and end earlier from this semester on so that the committee is able to evaluate the applications earlier. Non-EU-students will need at least four months for preparation, visa acquisition and finding housing. Another way to speed up visa processes is that the master's office informs the DAAD about admitted applicants regularly. Students from countries like India or China need a certificate from the Academic Evaluation Center (in German: "Akademische Prüfstelle (APS)"). The APS certificate is a mandatory part of the documents that have to be submitted for visa applications. Therefore, already admitted applicants will be prioritized for their APS certificate in the German embassies.

Many students were not able to arrive in time in the first semesters. Therefore, as a pilot program, the study program offers many lectures online so that the students were able to start studying while still waiting for their visa. It took great efforts to assemble enough online classes in all of the four majors. As exams are usually taken in presence, these students need to arrive in Germany until the exam period starts at the end of their first semester. If they will not be able to arrive, they may de-register and apply again for the upcoming semester. Anyway, they will be able to take the exams in the next semester, as exams are usually offered twice a year in both winter and summer semester.

Finding accommodation in cities with more than 100 000 inhabitants is challenging, especially if it has to be completed in a short period of time. It might be easier for students to find accommodation in summer semester, as in general most of the students, especially bachelor students, start studying in winter semester.

There are some advantages and disadvantages of a study start in summer semester as shown in Table 1. The advantages regarding the flexibility and attractiveness of the study program (see also section 2.1) and finding housing were already mentioned. Especially these two aspects contributed to the decision to offer an additional study start in summer semester. In addition, the administration tasks will be spread over the whole year. The main disadvantage of a study start in summer semester in general is that it is often not possible for bachelor's programs with their relatively fixed structure, e.g. Math 1 followed by Math 2 followed by Math 3. As

master's programs often have more flexible structures, it is easier to offer a summer start there.

Table 1. Pro's and Con's for additional study start in summer semester

Advantages	Disadvantages
<ul style="list-style-type: none"> • More students are attracted as they do not have to wait until the next winter semester if they want to study in a master's program • Finding student housing might get easier as the students do not compete with bachelor's freshmen who start to study in winter semester • The tasks for administration of the applications are spread over the whole year 	<ul style="list-style-type: none"> • Difficult to realize in bachelor's programs, where many modules build on each other, while the realization is much easier in master's programs with more flexible study structures • Applications and study information events must be handled each semester

Especially international students have a lot of questions regarding their studies in a foreign country that may differ in organization of their previous studies. Therefore, it is necessary to give detailed advice on the procedures, their studies and general issues.

4 SUMMARY

Based on the practical experience with the new international pilot study program, issues and solutions were discussed in this paper. The following conclusions are drawn that should be taken into account when planning and setting up a new international study program:

- Global trends and interdisciplinary research areas affect the popularity of international study programs. Different majors in a master's program open up the possibility for applications from different bachelor's programs.
- The evaluation procedure has to be suitable for the respective number of applicants. With a high number of applications, the professional review is performed first; a full formal check is performed later only if necessary.
- An early start and end date of the application period is necessary to issue admissions early enough, so that foreign students will have a chance to prepare for their studies at the university. Non-EU students need at least four months for visa application for Germany.
- A study start twice a year (each semester) is recommended if the structure of the study program allows it.

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