

# **Exchange Report**

**Technische Universität München (TUM)**

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## Introduction

I took part in Erasmus exchange at Technische Universität München (TUM) during the summer of 2023 as a part of my master's degree studies. I applied for the exchange together with my partner so it was important to find a destination that would work for both of us. We both study at Aalto University in different schools of engineering with different exchange databases. When looking for an exchange destination our main search criteria was to find a common destination at a German-speaking country. TUM in Munich stood out as the best alternative for us.

## TUM Application

After being nominated for exchange from Aalto, there was a separate application process for TUM. For the 2023 summer semester the application deadline was in the end of October 2022. The application consisted of the following documents:

1. CV
2. Motivation letter
3. Language certificate

For the language certificate, it was enough to request a certificate from Aalto language center after completing a mandatory English language course as a part of my bachelor's degree.

We received acceptance letters from TUM in the beginning of December.

## Enrolment

After admission, the next step was to enroll at TUM in order to receive an account for university systems that would be used during the exchange. Enrolling had the following prerequisites:

1. Pay the 2023 summer semester fee (152.30€)
2. Register with a German health insurance fund

A valid health insurance subscription (Krankenversicherung) is mandatory for all university students in Germany. EU citizens are covered by their EHIC card, but one still needs to register with a German insurance company. In practice, you need to scan and email your EHIC card to some insurance provider who will then forward the information to TUM. I registered with AOK Bayern because they provided clear instructions in English. There were some requirements for the validity period of the EHIC card. In my case, I had to order a new card because my old card would have expired during the exchange which was not allowed.

I highly recommend completing the enrollment process as soon as possible because many useful resources, such as the TUM Living platform, are only available for enrolled students.

## Accommodation

It quickly became apparent that it would be very difficult to find housing in Munich, especially as an exchange student. After reading reports from earlier exchanges, I already had the impression that it would be a difficult task. TUM organized an information session to help with the accommodation search. The main takeaways from the information session were:

1. Start early
2. Physically come to Munich to search for apartments
3. Be wary of scams.

I abandoned my studies at Aalto for a week in January to travel to Munich to look for accommodation. Even when staying in Munich it was a difficult task. In the info session, they advised to look for rental listings printed in local newspapers but I had no luck in finding any realistic

offers. There were around 5 announcements of people *looking for* accommodation for every listing of apartments to be rented. Most landlords want to see all kinds of paperwork before even letting you visit the apartment, including bank statements, proof of insurance, acceptance letter from TUM, and so on.

In my understanding, typical rental prices in Munich are around 1000€/month for a studio and 1200€/month for a two room apartment. In addition, landlords typically require two to three months rent as a security deposit so you can easily end up having to pay thousands of euros in advance. Apparently scams are also very common, which is why it was recommended to do the search in person and only pay after you have physically seen the apartment and signed a rental agreement.

In the end, I managed to find an apartment during the last day of my stay in Munich through an internal accommodation marketplace for TUM students called TUM Living<sup>1</sup>. It is only possible to access the TUM living service after completing the enrollment process so I recommend doing it early.

We shared a two room apartment in central Munich near the U3 U-Bahn line. Being close to the U3 line is very convenient if you have lectures in the Garching campus. The rent was around 1200€ per month including utilities (Warmmiete) meaning that each of us had to pay around 600€ per month on rent. Based on discussions with other students, we were very lucky with our accommodation. Many students were paying similar amounts for a room in a shared apartment at a more remote location.

We had to take a private liability insurance (Privathaftpflichtversicherung) as a condition of the rental agreement. I chose a German insurance company which was somewhat tricky due to the language barrier, but German companies were much more affordable at around 7€/month than the alternatives advertised to English speaking international customers.

There was some bureaucracy associated with moving to Germany. After moving into Munich one has to register as a resident within two weeks of arrival at a local registration office (Kreisverwaltungsreferat). In addition, it was mandatory for each household to pay a public broadcasting fee (Rundfunk) which was around 55€ every three months.

## Payments

One notable difference between Germany and Finland is that cash payments are still very prevalent in Germany. In many contexts it was not possible to pay by card at all. In my experience from an earlier trip to Germany, the situation used to be much worse but nowadays most stores already have payment terminals. However, small stores such as bakeries often do not. Apparently, the adoption of card payments was sped up significantly by the Covid-19 pandemic. Nevertheless, I still encountered situations where my card would simply refuse to work with a given payment terminal so I would still recommend carrying some cash around just in case.

Another peculiarity regarding payments is that German companies seem to prefer direct debit as a method of invoicing bills. TUM instructed us to open a German bank account for these kinds of payments, but it is also possible to use a Finnish bank account after authorizing direct debit for your account. In a direct debit contract you authorize the service provider to directly withdraw funds from your bank account. I personally dislike the system because there are no controls in place to narrow down who can withdraw funds from your account once they know your account number. Therefore, I would recommend setting up a separate bank account for

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<sup>1</sup><https://living.tum.de/>

German payments even if sticking with a Finnish bank. Unfortunately, in many cases direct debit was the only accepted form of payment. For example, when paying for university sports activities at ZHS or when signing up for the liability insurance.

## Studies

The academic calendar is somewhat skewed compared to Finnish academic calendar. The academic year is divided into two semesters: winter semester and summer semester.

The summer ran from April 1 to September 30. However, the studies themselves spanned a much shorter interval. The rough timing of the semester (based on the courses I took) was:

- Orientation: April 4 - April 14
- Lecture period: April 17 - July 21
- Exam period: July 21 - August 10

The beginning of the summer semester overlaps with the fourth and fifth periods at Aalto, which might be difficult to fit together with Aalto studies if you have compulsory major courses in the spring like I did.

## Orientation

Before the beginning of the semester, it was possible to pick up your TUM student card from the campus. When picking up the student card, TUM also provided a welcome bag filled with information leaflets about the city and exchange studies at TUM.

In the beginning of the semester TUM arranged a hybrid info session for all new exchange students. In addition the department of Electrical and Computer Engineering arranged an additional in-person welcome session. Besides the welcome sessions, there were no other official orientation programme from the university.

The TUM branch of the Erasmus Student Network (ESN TUMi) organized some orientation activities in the beginning of April. I arrived to Munich only after the orientation so I don't know what was involved. They also organized short campus tours in the beginning of the semester.

The TUM university library also offers library tours that give an overview of the library facilities and the resources you have available as a student. I found the library tour quite useful.

## Registering for Courses

Course registrations were done through TUMonline which is an online system similar to SISU. After enrolling for courses, the course materials were available on Moodle which resembled MyCourses. The course registrations for lecture courses closed quite late into the lecture period so there was no rush to sign up.

There was a separate deadline for registering to practical lab courses. The deadline was already on April 5 before many exchange students even had arrived in Munich, but the lab courses themselves take place *after* the exam period around August. Places were not guaranteed for exchange students. I applied for one lab course in April but was assigned a confirmed place only in the beginning of August. I would not recommend basing much of your exchange credits around lab courses due to the associated uncertainty.

At least 60% of the courses had to be taken from the faculty organizing the exchange. For me that was the faculty of Electronics and Computer Engineering.

TUM had a much wider range of choice of courses in computer engineering compared to Aalto University. My main interest was to study courses related to System-on-Chip (SoC) design which are not available at Aalto. At master's level many courses were offered in English. However, some courses alternated between German and English between summer and winter semesters. Unfortunately, most of the courses I wanted to take were either organized in the winter semester or were taught in German during the summer semester. Nevertheless, I still managed to find many interesting courses that nicely complement my degree courses.



Figure 1: Clock tower at TUM main campus.

Most of my courses took place at the main campus in central Munich. The lecture halls in the main campus are quite dated, but get the job done. However, during the mid summer heat, the older lecture halls without air conditioning were somewhat unpleasant. The teaching style was very much lecture-based. Some courses had exercise sessions, but those mostly involved a TA working through examples problems in a lecture hall rather than assigning exercises for the students. Any practical courses were organized as separate lab courses.

## Courses Taken

I attended the following courses at TUM. All of the courses were master level courses, except maybe the language course.

In total, I completed six courses summing up to 32 ECTS as elective studies. My initial plan was to complete only five courses, but I took one extra course in order to allow for some leeway in case I failed a course.

### 1. 220000DE18 – German as a Foreign Language B1.1 – 4 ECTS

Before the exchange, I had only studied German 1 and German 2 language courses at Aalto. This course was mostly taught in German, but the teacher talked at a level appropriate for B1 learners which made it very good for developing listening comprehension. I think attending this course helped me far more in understanding spoken German than everyday interactions in Munich.

### 2. **EI70730 – Memory Technology for Data Storage – 5 ECTS**

This was by far my favorite course at TUM. The course was a very valuable compressed set of information about different memory technologies and their basic fundamental principles. The professor teaching the course had a down-to-earth approach that valued comprehension of fundamentals over exam performance, which I preferred over the exam cramming approach of most other courses. The course was also closely connected to research with weekly reading assignments of relevant research papers.

### 3. **EI7271 – Chip Multicore Processors – 6 ECTS**

This course was a high-level overview of hardware and software issues of multicore processors. The course had a prerequisite course that is only taught in the winter semester (SoC Technologies) but luckily I had studies similar topics elsewhere. The course consisted of lectures and pen and paper exercises.

### 4. **EI70630 – HW/SW Codesign – 5 ECTS**

This course was a very high-level look at methods of hardware/software system codesign. I feel like the course was very abstract and still would not understand how to apply the studied concepts in practice. Teaching was mostly lectures and exercise sessions where the TA worked through example problems in a lecture hall.

### 5. **EI7494 – Numerical Linear Algebra for Signal Processing – 6 ECTS**

This turned out to be the most difficult course I took at TUM. The course walks you through the numerical properties of different algorithms in linear algebra in the context of DSP. It was permitted to provide up to five double sided A4 cheatsheets for the exam so proper preparation for the exam was a must. I was quite worried about whether I could pass this course or not so I took an extra course just to make sure I am able to complete enough credits during the exchange.

### 6. **CIT4410012 – Laboratory on System Design for High-Frequency and High-Datarate Applications – 6 ECTS**

This was a one week long intensive lab course at the Garching campus that required full-time attendance (8 hours a day for 5 consecutive days). The course consisted of three days of high-speed PCB design using Altium Designer and two days of RF simulations using Ansys HFSS. During the digital portion I had the opportunity to lay out a DDR3 interface between two BGA chips on a 10-layer PCB. The course was graded based on a final report written after the lab sessions.

## **Exams**

At TUM you have to complete modules instead of courses to earn credits. I still don't quite understand what is the relationship between courses and modules but there is *some* difference and only completed modules give credits. In each module, you had to separately enrol for the course exam. The deadlines for enrolling for exams were strict and missing the deadline meant that you couldn't attend the exam and therefore would not pass the module.

All of the lecture courses I took were exclusively graded based on the final exam. In practice this means that the whole semester is evaluated based on a single high-stakes exam at the end of the semester. To make things worse, the exams are time constrained to make them even more difficult. This is very different from Aalto where you are rewarded for active participation and can take your time in the exam. I prefer the Aalto way of teaching. As an exchange student

it was not clear to me if or when I could retake failed exams so I prepared for them accordingly. Near the exam time, the university libraries were always full to the point where it was difficult to find free spaces to study.

## **Food**

The main campus was located in the city center with many nice restaurants around. Next to the main campus was a “Mensa”, which was essentially a very large student canteen. One peculiarity about the Mensa system was that you could only pay using your student card. In order to pay with the student card, you had to first deposit cash to your student card using machines at the Mensa building. In effect, this meant that I had to periodically withdraw cash from an ATM and immediately deposit it on my student card in order to eat at the Mensa.

The price of the meal depends on what you eat and how much. At the counter, the food is weighed and the price is determined based on the type and amount of food. The vegetarian options were generally cheaper. On an average day I spent about 4.50€ on lunch when taking a similar portion as in Finnish student canteens. As there was only one mensa building near the main campus, the queues could get quite bad at peak times. Definitely much worse than the peak-time queues in Otaniemi.

There were also vending machines scattered around the campus using the same TUM student card payment system. These were quite convenient for snacks for example when studying at the library.

## **Getting Around**

During the first month of the exchange the student card was valid as a public transport ticket in whole Munich area. This might have been a special arrangement during 2023 spring as Germany adopted the country wide Deutschlandticket on May 2023. Starting from May, the student card was only valid for public transport during off hours.

The Deutschlandticket is Germany’s new country-wide public transport ticket that allows you to use local public transport everywhere in Germany for 49€ per month. This includes low-speed regional trains, but not the highspeed IC and ICE trains. I heard that the Deutschlandticket will be reduced to 29€ per month for students starting from the next winter semester.

## **Pastime**

Munich is home to many nice museums and restaurants. When eating out, the prices are bit cheaper than in Finland when it comes to food. When it comes to beverages, Germany is much cheaper and has better quality. I recommend visiting a traditional restaurant and trying out a Maß of beer together with traditional bavarian food.

## **University Sports**

Sports courses and facilities were offered to students through an organization called Zentraler Hochschulsport München (ZHS). The course registrations closed quite early before I knew about them so you must be early if you want to book a place for a certain sport. In addition to courses, ZSH offers tickets for accessing sports facilities at the Olympiapark campus with a Basic-Ticket costing 10€ per semester. In addition, I booked a B-ticket for bouldering which was very reasonably priced at 50€ for the whole semester. With the B-ticket it was possible to book up time slots for the bouldering facilities. I think the booking system was nice as it guaranteed the walls were never too crowded.

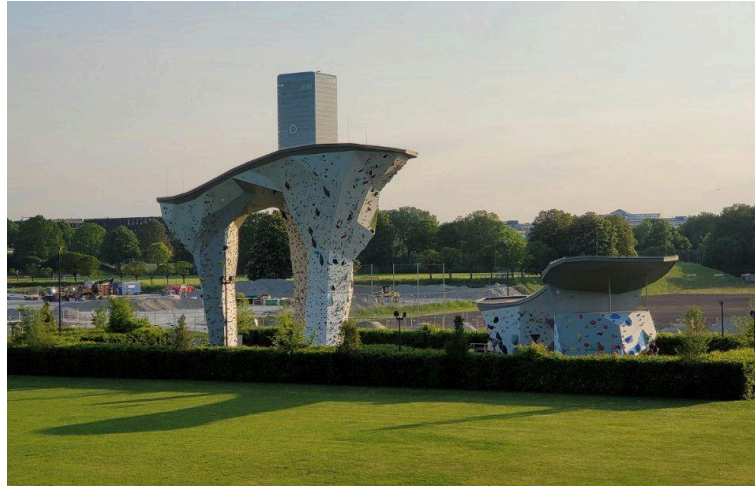


Figure 2: Outdoors climbing and bouldering facilities at ZHS.

## Hiking

Munich has an amazing location for hiking. The early alps can be reached from Munich within one hour using a local train from Munich hbf. Best of all, the local trains are covered by the Deutschlandsticket so hiking is practically free if you already have the ticket. Hiking seemed to be a very popular pastime and the local trains could get full especially in the weekends. It is a good idea to wake up early and take an early train to avoid the crowds.

I attended several guided hikes organized by ESN TUMi. The most exciting event was a two day hike to Estergebirge where we slept overnight on a hut on the top of a mountain.

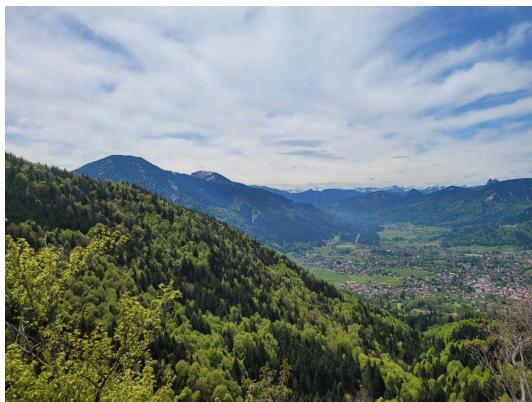


Figure 3: Pictures taken from a hike at Baumgartenschneid.

## ESN TUMi

The TUM branch of Erasmus Student Network (ESN TUMi) was very active at organizing events for exchange students. The events were also quite popular among TUM degree students so attending TUMi events was a nice way to meet both other exchange students and TUM degree students. I mostly attended their hikes, but many other kinds of events were organized as well.

## Summary

All in all, the exchange was an amazing experience and provided a welcome break from everyday routine in Finland. Munich is a lovely city that I also wish to visit in the future. Having the opportunity to study at an another university also gave good perspective on my studies in Finland. Before the exchange, I had already lived abroad in an English-speaking country, but



it was interesting to experience living in country where I'm not fluent with the main spoken language. At least, my German skills improved significantly!

The timing of the German semester together with the absences caused by the accommodation search were difficult to fit in with my studies. The accommodation search in particular was very stressful because I did not speak German very well and had to sacrifice time and money on the trip without knowing whether I would be successful. I would like to express my gratitude for SIL for their support. The grant helped significantly with the initial expenses.