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1. Introduction

This Study Management Guide was compiled by the student management advisors of Education and Student Affairs (ESA) at Eindhoven University of Technology (TU/e). In it, you'll find information, tips and exercises to help you get the most out of your degree program and achieve the best possible results.

Education is a process that involves both content (subject matter) and a particular approach to that content. These two elements, content and skills, are inextricably linked. Strategies that help one person to make good academic progress may not work at all for someone else. Though there is no one right way to study, hopefully this guide will give you some helpful tips, examples and background information.

How you shape your studies is up to you!

The student management advisors at Education and Student Affairs (ESA) wish you every success as you pursue your degree. If you have any questions and/or comments regarding this guide, procedures relating to your degree program or studying in general, please feel free to contact us. The ESA is located in the Metaforum building. You can also contact us at 040-2474747 or send an email to esa@tue.nl.
2. Learning and Studying

In high school, everything revolved around “learning”. Universities call this “studying”. Is there a difference? Yes and no.

Yes, because the overall education system is different at university and you can choose whether or not to attend lectures and whether to study more on your own.

No, in the sense that “studying” basically involves the same things as “learning”. Let’s first consider what is meant by “learning”, using an example from high school.

Remember your first math lesson on the quadratic formula? Probably not. More than likely, it sounded like mumbo-jumbo at first. But the way teaching is structured in high school meant that after seeing the demonstration you could immediately try your hand at a few quadratic equations yourself, complete a homework assignment on your own for the next day and by week’s end you could practically solve quadratic equations in your sleep. After this came a series of lessons in different uses of the quadratic formula, culminating in – surprise! – a test on the quadratic formula. Which you aced, of course.

The process you followed in high school can be plotted out in what is called a “learning curve” or “forgetting curve”; after all, learning and forgetting go hand in hand.

It turns out that people’s ability to remember a subject grows in proportion to how often they study it [1]. The graph above shows that after reading about a subject once, people are likely to remember about 20%. The more often you review something, the easier it is to remember. On average, students need five “offers” of information to be able to benefit from it sufficiently.

At the TU/e, lectures and instruction groups comprise two such offers; the rest you have to do yourself (independent study). Intermediate assessments also contribute to starting on time with studying.
2. Learning and Studying

Mariana van Hoek, 1st year Industrial Engineering and Management Sciences

“I’d earned good grades in high school and assumed I basically knew what I needed to get off to a strong start at TU/e. This was true, only the pace was faster than I’d expected, and from the very beginning I had to really work to keep up. Actually, I had become a passive learner, because I’d never learned to review the material again after class. Now I know that the only way to remember the subject is by going over it again on my own.”

Juan Bergen, 1st year Electrical Engineering

“The number of times we went over things in high school, where we might repeat a topic 20 times, is too much, obviously. But just attending lectures and instruction groups and reviewing the theory for the exam isn’t a guarantee for success either! For each course you have to find the right mix. Studying means making the most efficient use of your study time and the course material.”

Loes hurkmans, 2nd year Industrial Design

“Because ID is set up in semesters, it’s sometimes harder to stick to a steady work routine. It takes discipline to study – especially during periods when it’s less busy. You need to keep up with the material and get all the information down, but sometimes that’s tough, especially right before a deadline. For me, I know it’s easier to be at my best when I have a good overview and am on schedule.”

Mariana van Hoek, 1st year Industrial Engineering and Management Sciences

“Because ID is set up in semesters, it’s sometimes harder to stick to a steady work routine. It takes discipline to study – especially during periods when it’s less busy. You need to keep up with the material and get all the information down, but sometimes that’s tough, especially right before a deadline. For me, I know it’s easier to be at my best when I have a good overview and am on schedule.”

What about you? How do you think you’ll do?
3. Learning Styles

People learn in different ways. The learning process can be divided into several phases, which include gathering information, testing new insights and thinking about things you’ve experienced. In his research on different learning styles, the American psychologist David Kolb identified four distinct phases [2,3]:

These four phases follow each other in a logical sequence: whenever you experience something (concrete experience), you need to look back and think about what you experienced (reflection). Next, you define it (conceptualization) and formulate a strategy to use in comparable situations in the future (testing).

Kolb describes this as a cyclical process that should always take place in the same sequence (though not necessarily from the same starting point). However, different people prefer different phases of this cycle; that is, they are naturally inclined to start in a specific phase or to spend more time in it.

Kolb further discovered that people tend to concentrate on developing the specific learning phase in which they are naturally strong. He argued that people should also focus on learning methods in which they are less strong. This makes it possible to complete the entire learning cycle in a more balanced way, with each phase getting the attention it deserves.

The four different learning styles are described on the next page.
Dreamers observe how other people handle a problem and think before taking action. Their ability to view a problem from lots of different angles means they also see lots of possible solutions. This means it can take them longer to make a decision.

*Likely to say: What’s new? I’m open to anything.*

Thinkers are good at logical thinking and reasoning. They try to discover overarching rules and prefer to learn from books. For these people, it’s more important that an idea is logical than that it is practicable.

*Likely to say: I’d like some time to think it over.*

Deciders plan a task and carry it out. Theories don’t interest them all that much. They score high on conventional intelligence tests and prefer technical problems over dealing with people.

*Likely to say: How do those things relate to each other?*

Doers like to experiment and solve problems by trial and error. They adapt well to new situations but their drive for action can also come across as overbearing.

*Likely to say: How can I apply this in practice?*

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### @ Internet

Interested to find out which learning style fits you best? There are a wide variety of learning style tests available on the internet, which you can fill out and get an immediate result. You can find them by doing a Google search on “Kolb learning style questionnaire”.

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### ! Tip

Try to find out which learning style you use and how it affects the way you study.
4. Setting Goals

Your goals influence your behavior. If you don’t have goals, it doesn’t really matter what you do. Imagine you go out for a drive. If you don’t have a goal, it doesn’t matter if you turn left or right or if you take the freeway or a dirt road. But if you want to take in the scenery, you have a goal. Then you know to take the picturesque rural road instead of risking traffic jams on the freeway.

Goals are convenient because they help you make decisions. This applies not only to you individually, but also to groups and organizations. If a group is discussing an issue that the members can’t agree on, referring back to their shared objective can help create a breakthrough. But how do you set realistic goals?

“\textit{A vision without a task is but a dream, a task without a vision is drudgery, a vision and a task is the hope of the world.}”

\textit{– from a church in Sussex, England, c. 1730}

4.1. SMART goals

Setting goals is often confused with having good intentions. Take people who resolve to quit smoking on January 1st. Is “to quit smoking” an intention or a goal? The answer is that it’s a good intention, because if you succeed you’ll lead a healthier lifestyle and may also make things pleasanter for the people around you. But as a goal, “to quit smoking” is fairly vague. When will you quit smoking? Now, or in two weeks? And what exactly do you mean by “quit”? Does it mean smoking just one cigarette a day, or one every now and then at parties, or does it mean going cold turkey?

Setting good goals means setting SMART goals [4,5]. A goal is SMART if it is Specific, Measureable, Attainable, Realistic and Time-based.

```
Exercise

**Specific**
Your goal shouldn’t be vague; make it as concrete as possible.

**Measureable**
You should be able to verify that the goal is being translated into actions you can define and measure.

**Attainable**
It should be clear who needs to do what to achieve the goal. This is particularly important in the case of group goals.

**Realistic**
This means setting goals you know you can actually accomplish. Sometimes, goals are so ambitious that they’re all but impossible to achieve. And not achieving a goal is demotivating. Conversely, goals that are not ambitious enough are easy to achieve but won’t bring much satisfaction.

**Time-based**
Define a clear start and end time. When will you start carrying out the activities needed to achieve your goal and when will you have accomplished it?
```

I want to earn (measurable) my driver’s license (specific). To do this, I need to complete (attainable) 20 driving lessons and do a test (realistic). I want to have my driver’s license before January 1, 2016 (time-based).
5. Planning & Time Use

Most departments have a fairly strict schedule in the first year, but you’ll still need to keep close track of time yourself, too. Making a schedule and following it are processes that require personal initiative, perseverance and the ability to see things through.

<table>
<thead>
<tr>
<th>Would planning be useful for me?</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Even after sitting down at your desk to study, it takes a long time to really get down to work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instead of studying, you start off doing all sorts of other little things.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You might start on one subject, but before long you switch over to something else.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You have a sense of having more work than you can handle.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You work sporadically: one moment you have virtually no work to do and at another you have far too much.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You notice that you’ve been missing an awful lot of lectures and/or instruction groups lately.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You notice that you can’t really keep up with the subject matter and haven’t even tried to do the assigned exercises.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If any of the “problems” described above sound familiar to you, it may be a good idea to start using a planning schedule. [6].

Bram Hoevenaars, 2nd year Industrial Engineering and Management Sciences

“Working according to a plan isn’t about putting in more hours; it’s about distributing those hours better and studying more efficiently. How many hours you want to study is something you have to decide yourself!”

Achmed Birksan, 1st year Applied Physics

“In my first semester, I didn’t do much planning as I had no problem keeping up with the course material. But in the second semester I noticed that sticking to a schedule helped me stay on top of things better. It also made me feel calmer. Having a good planning schedule means I know that I’ll be ready when it comes time to take exams.”

Marije Sleutjes, 2nd year Chemical Engineering

“For me, sticking to a fixed study schedule works best. As I have a regular study rhythm, I also know when I have time to spend on hobbies like horseback riding and other fun stuff.”
5. Planning & Time Use

5.1. Time Use
To make a planning schedule, you first need insight into how you organize and spend your time: at which times can you study, how much time do you need for non-study related activities, at which times do you study best, and so on.

Keeping track of your activities on a time-use form is a good way to gather this type of information. Using the form and color codes, you can record in detail what you do and how much time you spend doing it. You fill out the form after doing the activity; the best time is at the end of the day, when you still know exactly what you did that day.

The form is intended to furnish a record of your activities over the course of one week. Provided you keep careful track of each day, at weeks' end you'll have an overview of the number of hours you spent that week on education (lectures, instruction groups, lab courses) and what you did the rest of the time.

How do you spend your time?

<table>
<thead>
<tr>
<th>Hours per week</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>168 hrs</td>
</tr>
<tr>
<td>Sleeping</td>
<td>- 56 hrs</td>
</tr>
<tr>
<td>Eating, getting dressed, etc</td>
<td>- 28 hrs</td>
</tr>
<tr>
<td>Working</td>
<td>- 8 hrs</td>
</tr>
<tr>
<td>Shopping, cleaning, cooking, etc</td>
<td>- 7 hrs</td>
</tr>
<tr>
<td>Sports / hobbies</td>
<td>- 6 hrs</td>
</tr>
<tr>
<td>Relaxing, breaks</td>
<td>- 21 hrs</td>
</tr>
<tr>
<td>Total remaining for studying</td>
<td>42 hrs (!)</td>
</tr>
</tbody>
</table>

The time-use form also comes in useful to answer questions such as: How many hours am I spending on studying (in class, groups, independently) and how is this time distributed over different courses? At which times do I normally study, how much time do I spend on hobbies, going out, eating, etc.? On reviewing your record of the week, you may find you're using your time quite differently than you thought. In that case, you can decide to change the way you allocate your time.

Planning Tip 1
Keep track of everything you do over the course of the week and then adjust your planning schedule as needed. Also keep track of when and why you deviate from your schedule and use this information at the end of the week to set goals for the week ahead. A planning schedule should be dynamic, not static.
Assigning color codes provides a simple way of indicating to which category an activity belongs. Use the “unavoidable” category for things like travel and work. Also, make sure you don’t count the breaks between lectures as hours spent studying.

If there are any activities that don’t fit into the categories provided, you can list them separately on the form. However, try to stick to the color code as much as possible, so you can see at a glance how the categories are distributed over the days. Also, this makes it easy to compare forms for different weeks with each other or with those of other students.

It’s best to record your activities at the end of each day. At the end of the week you can calculate per day and per week:

a) The total number of hours you spent studying (red + green);

b) The total number of hours you studied on your own (red).

Next, you can identify how the hours you spent studying on your own were distributed over the different components of your curriculum.

Be aware!

People differ in how much time they are able and wish to invest in an activity, which naturally affects how much time you ultimately spend.
5. Planning & Time Use

5.2. Planning

5.2.1. Types of planning
There are two types of plans you can use, depending on what you’re planning: a time plan or content plan. Time planning involves determining in advance how much time you want to spend on studying during the period for which you are creating a schedule. Content planning, by contrast, means deciding to get a certain amount of material done regardless of how much time it will take.

- A time plan is useful when:
  1. You’re not satisfied with the total amount of time you’re spending studying on your own (too much/ too little).
  2. Your performance in certain courses is suffering because you’re not spending enough time on them.
  3. You’re unhappy about the times at which you’re studying (e.g. too irregularly, fragmented, late in the evening or at night).

In other words, everything in this plan is based on time. Of course, you still need to keep track of how much you can get through in this time. In the case of content planning, everything revolves around the material you need to learn. In this case, you opt to get through a certain amount of course material no matter how much time is involved.

- A content plan is useful when:
  1. Your goal is to keep up with the course material during lecture weeks, including both theory and assignments.
  2. You have not been able to get through all the material before exam time in the past.

5.2.2. Combination
In many instances you’ll find it works best to combine these two types of planning schedules. When planning for exams, for example, you should know exactly what you need to study for each course and how much time you have before the exam. The trick is to fit the material you need to study into the time available. This means looking at each day and planning what (how much) to do for which course.

If you run short of time, you’ll have to make choices about the best way to spend what time remains. In that case, knowing how much time you have left and which material you still need to get through to be sufficiently prepared for the exam is essential: a combined time and content plan offers a good solution.

Planning Tip 2
A planning schedule is always an estimate, and will always need some adjustment. Take this into account from the outset by including additional “buffer” hours and keeping your goals within reach.
5. Planning & Time Use

5.2.3. Short and long-term planning
You can make planning schedules for various intervals. For example, you can plan per week, for an exam (e.g. three weeks ahead of the exam period) or you can create a long-term plan for a semester-long course, an internship or for the time until graduation.

Weekly plan
A weekly plan is designed to help you keep pace with lectures and instruction groups. Since your focus is on content, this is what you’ll base your plan on. If you can stick to this schedule for a full three months, you should be well on your way to being prepared for your exams.

To make a good planning schedule for the week you’ll need to know a few things:

1. The lecture, instruction group, lab DBL times, etc. for each course.
2. Meetings and appointments, e.g. sports team meetings, nights out, etc.
3. The amount of time you need for shopping, cooking, eating, cleaning, travel, etc.

One way to get this information is by keeping track of activities using the time-use form (see p. 10).

<table>
<thead>
<tr>
<th>Planning schedule for the week of .... - ....</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>07.00 am</td>
</tr>
<tr>
<td>08.00 am</td>
</tr>
<tr>
<td>09.00 am</td>
</tr>
<tr>
<td>10.00 am</td>
</tr>
<tr>
<td>11.00 am</td>
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<tr>
<td>12.00 am</td>
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<tr>
<td>01.00 pm</td>
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<tr>
<td>02.00 pm</td>
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<tr>
<td>03.00 pm</td>
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<tr>
<td>04.00 pm</td>
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<tr>
<td>05.00 pm</td>
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<tr>
<td>06.00 pm</td>
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<tr>
<td>07.00 pm</td>
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<tr>
<td>08.00 pm</td>
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<tr>
<td>09.00 pm</td>
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<tr>
<td>10.00 pm</td>
</tr>
<tr>
<td>11.00 pm</td>
</tr>
</tbody>
</table>
5. Planning & Time Use

Once you have this information, you can start setting up your weekly planning schedule. Bear in mind the following:

1. Include time buffers. These are hours you reserve for studying but in which you don’t actually plan any study activities. Should your planning schedule turn out to be overly optimistic (an exercise took longer or the material was more complex than expected, or something else came up), then you can use the buffer to make up for the lost time. If you finish on or even ahead of schedule, the buffer is yours to use as you wish!

2. At what time of day do you concentrate best: morning, afternoon, evening? Schedule your study time accordingly.

Planning Tip 3
When planning, the best strategy is to work backwards. This means you schedule your study activities over the available weeks in reverse, starting from the day of the exam up to the present. That way, you won’t reach the end of your schedule and realize you haven’t allowed enough time, forcing you to start planning all over again.

Planning Tip 4
Take your own preferences into account when planning study time. Are you someone who prefers to spend a long time focusing on one subject, or would you rather alternate between different subjects?

Long-term plan
Once you have learned to make a good weekly plan (and to stick to it!), you can move on to creating a plan for several weeks – that is, a long-term plan.

Instead of planning exactly what to do at specific times, you write down which material you want to tackle each day in order to be prepared for your exams. Since you’ll know in advance what you want to get through over the weeks ahead, you’ll also have a timely indication if the amount of material is more than expected, and will still have enough time to plan buffers for any components for which you need more time.

Exam plan
It almost goes without saying that there’s no better way to prepare for an exam than by making an exam planning schedule. Planning for exams is discussed in greater detail in Chapter 12: Examinations.
5. Planning & Time Use

Do you ever have difficulty sticking to your planning schedule? Using the space below, describe which factors are getting in the way and how you plan to address them. Also specify the date on which you want to tackle each item.

Excercise

Make a planning schedule for one week and enter your activities for each day in the table below. At the end of the day, write down how the day went. Did you finish all the tasks you had planned, or were there things you didn’t get around to doing?

1. If you finished all your tasks, color the box green; if you didn’t, color it red.

2. How many green boxes are there at the end of the week? Are you happy with this result?

<table>
<thead>
<tr>
<th>What did I plan?</th>
<th>How did it go?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td></td>
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<tr>
<td>Friday</td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td></td>
</tr>
<tr>
<td>Sunday</td>
<td></td>
</tr>
</tbody>
</table>
6. Time and Stress Management

People are often quick to say how busy they are and how much they have to do. Just think of how many conversations you’ve had that started with: “How have you been?” “Oh, I’ve been so busy!” In fact, a certain degree of pressure, tension and stress in your studies or work is usually a good thing. Most students need some kind of pressure to keep up their drive and be creative. However, more and more students are also complaining about work and/or academic pressure.

Stress can have all sorts of causes. Often, it’s more about what’s going on in your head than about what’s on your to-do list. It may not even be clear why you feel things are getting on top of you. In most cases, it’s mainly to do with the combination of lots of activities and too much fragmentation. Understanding which activities need to get done and how much time they will take is a key part of tackling this problem. This is at the core of what’s known as time management.

Despite the above, there is a point beyond which the pressure of work and study can become too much, undermining your enthusiasm for what you’re studying and perhaps even leading to physical symptoms. If this happens, you should consult your doctor or visit the ESA. They can teach you strategies for dealing with tension and stress.

6.1. Time management

Time is a key resource for getting work done and should be used wisely. Poor time skills are also a major stress factor, alongside the fragmentation mentioned above. Since work often involves high pressure, you simply have to make choices.

To make good choices, you need to know where your priorities lie. How do you determine your priorities? What can you do to gain time? How do you use planning schedules? You can rank activities according to their proper priority by considering two factors [7]:

1. How important is it?
2. How urgent is it?

![Diagram showing the relationship between importance and urgency]

Exercise

Draw up a list of all the activities you need to do and assign a priority to each based on the following:

1. What are your goals/what do you want to accomplish?
2. What do you need to do for this to happen (which activities do you need to carry out)?
3. Rank your activities by priority.
4. Plan the activities.
Another crucial part of managing time is identifying things that are likely to use up a lot of time ineffectively [8], or so-called "time-consumers". Read through the list below and put a check next to the factors that apply to you.

- No goals, priorities or daily work schedule
- Varying priorities
- Not finishing work
- Incident or crisis management
- Telephone
- No deadlines
- Daydreaming
- Hobby
- Wanting too much at once/unrealistic time estimates
- Lack of self-discipline
- Chaotic personality and/or workspace
- Hanging out
- Indecisiveness
- Unclear expectations/ insufficient information
- Wanting to do it all yourself
- Too caught up in routine tasks
- Email / Internet
- Overhasty decisions

Many of the time-consumers listed here probably sound familiar. What’s more, most of them are of your own making. But even when time-consumers are caused by other people, it’s still always up to you whether or not to respond. Naturally, there are times when you simply have no choice, but these are usually one-off cases. Just keep your priorities clear in your mind and if necessary make arrangements with those around you, so they also know what your priorities are!

Exercise

Time Tip 1

Instead of worrying about problems to which there is no immediate solution, concentrate on things that you can do something about.
6. Time and Stress Management

6.2. Stress management
To handle work pressure effectively, you need to know how to handle stress. Some people are naturally better at this than others. Where some people can transform stress into focus and can effortlessly switch between activities, others lose all perspective and start to panic.

Work pressure is defined as being too high when you don’t have enough time to finish the work you need and/or planned to, or when you have the feeling of constantly having to strain to the limit to reach the expected level. These things cause stress. If the stress is not too great and what’s expected of you lies just beyond your current capabilities, it is known as creative stress. Creative stress helps you learn, develop and expand your horizons.

When stress becomes too great, it detracts from your enthusiasm for studying, your creativity and your effectiveness. Over longer periods of time, it can even affect your health. Whether work pressure actually becomes too much to handle depends on a couple of factors:

1. Your stress load: the amount of work, the level of the work, how you carry it out and also stressors in your private life.
2. Your coping ability: your training, skills and overall health.

Conversely, too little work pressure is also not good for you. If you never have to push yourself, you’ll also feel the symptoms. Just consider: have you ever worked during a quiet period, such as summer vacation? When there’s nothing to do, the days can get awfully long. But then if you unexpectedly do get a busy day, it’s immediately more than you can handle. In other words, it’s all about balance.

6.2.1. Coping ability and stress load
Your ability to cope with work pressure depends on the stress load you are under and your ability to cope with those stressors.

Stress load
As a student, you’re usually juggling several balls at once. Each additional ball increases the stress load on your shoulders, including:
- One or more part-time jobs alongside your coursework;
- Time-consuming hobbies;
- Household chores;
- Relationships;
- Unsettled private life, such as when moving house.

Coping ability
Coping ability (or how heavy a load you can carry) varies from person to person and from one time to another. For example, if you’re coming down with the flu, your coping ability will be reduced. If you’ve been experiencing a lot of work pressure for an extended period, you coping ability will also be lower. Long-term stress has a snowball effect and, when prolonged, a heavy stress can lower your ability to cope. Studies have shown fatigue to be the primary source of symptoms. Being well rested, fit and alert to things that can cause fatigue and exhaustion is crucial and will help you get a handle on stress.

“Those who make the worst use of their time most complain of its shortness.”
– Jean de la Bruyere –
6. Time and Stress Management

5. Learn how to manage your time (take the Study Management course) and organize your work so that it fits into the time you have. Say no to anything that will lead to an overload.

6. Learn productive thinking: nine times out of ten, you yourself are a major factor in your own feelings of stress. Put things in their proper perspective and don’t think in terms of worst-case scenarios. Develop tricks to redirect your thinking.

Lifestyle

Lifestyle also influences resilience to stress. Increase your resilience by doing the following:

1. Get plenty of relaxation and seek out diversions.
2. Get regular exercise.
3. Eat healthy and regular meals.
4. Don’t smoke and don’t drink alcohol, or only do so in moderation.
5. Always try to get a good night’s sleep.

Time Tip 4

Try taking a brief “time out”. A short walk, for example, can work wonders. It’s important that you give yourself a moment of rest.

6.2.2. Build your stress resilience

A little stress won’t hurt you. In fact, it can even help you perform better. The trick is to make sure your stress load doesn’t reach – and stay at – a point that exceeds your ability to cope. The good news is this is something you can control.

Skills

1. Learn to set boundaries: say “no” more often!
2. Be clearer in communicating what you want (which means actually knowing what you want!). Tip: try to make a habit of replacing words like “must” with “want” and see if what you’re saying still holds true.
3. Learn to relax. It’s a fallacy to think that doing nothing automatically means you’re relaxed. Find a diversion!
4. Learn to recognize your personal stress signals so you can adjust your activities in time.

Time Tip 2

Transform negative thoughts into positive ones. For example, instead of thinking: “I can’t do this, I’ll never succeed,” think: “I’ll just try it, see how I manage, and if need be ask someone else to help out”.

Time Tip 3

Avoid drawing hasty conclusions: distinguish between the factual situation, your thoughts about it, and what you’re feeling.
6. Time and Stress Management

A little relaxation...
You are the best judge of what you need to relax during or after a stressful situation or period. Not doing anything only works when you’re relaxed already. The most important thing is to seek a diversion. The following activities may help:

1. Taking a short walk as a break from studying.
2. Allowing yourself ten minutes’ time to daydream about a perfect tropical vacation.
3. Relaxation exercises.
4. Cooking a nice meal.
5. Sitting quietly with a book.

6.3. Information stress
Information stress is a common complaint among students and knowledge workers. With the myriad of emails, newsletters, reports, entertaining video clips, important weblog notices, interesting links and lots more flooding in from all sides, it can be almost impossible to absorb and process all the potentially relevant information. The resulting sense of frustration can also lead to stress. Taking a smart approach to information flows will give you more free time and more headspace. [9, 10].

When you’re trying to study, all this information, including incoming emails, only serve as a distraction. Telephones, too, are a sure source of interruption. The way to tackle information overload is to change the way you deal with information, by being more aware of your own behavior and more assertive.

Set aside a certain time each day for email correspondence, for example at the end of the day, and don’t open messages at any other time of day.

Be selective in sending emails: the more you send, the more you’ll receive.

Turn off or unplug your telephone at times when you really need to focus on studying.

Time Tip 5
As contradictory as it may seem, when you’re in a stressful situation, try to relax. Relaxing will help you to order your thoughts and prevent you from acting impulsively. One way to relax is to focus on your breathing: take slow, deep breaths in and out from your abdomen.

Over longer periods of time, work pressure (possibly combined with other stressors) can build up and eventually lead to symptoms. Suffering from high work pressure is not just a problem for sissies or weak and nervous types – everyone has their boundaries. In fact, often it’s those people who always push that extra bit harder who are the ones to burn out. The key is learning to handle stress!
7. Motivation and Concentration

At any given time, a range of different factors can make it difficult for you to study. Students tend to blame reduced concentration or motivation, but what does this actually mean? What are the real causes of a lack of concentration or motivation? To begin with, they can be ascribed to either internal factors (the student) or external factors (the environment). If you want to improve your concentration and/or motivation, you first need to understand the true causes, and then do something about them.

7.1. Concentration
Concentration ability is the degree to which you are able to actively focus your attention. Normally, we can distinguish two states of concentration. The first is the state of absence, when your thoughts are directed elsewhere. The second is alertness, when you are highly concentrated, also known as being in a “flow”. Flow is the feeling you get when you’re totally immersed in something and lose all sense of time. It’s a state of inspiration and of being thoroughly engaged. Afterwards, you feel fulfilled and brimming with energy.

It would be great to experience this every time we study or are at work, but in fact achieving a state of flow depends on all sorts of other factors [11].

7.1.1. Internal factors
This section describes four internal factors that can influence your motivation and/or concentration.

Biorhythm
When studying, use your biorhythm as a guide: schedule your most difficult subjects at the times you’re at your mental peak (this means finding out for yourself if you study better early in the morning, in the evening after dinner, etc.). Plan easier tasks at times that you’re operating in a lower gear. You’ll also need to know how long you can remain fully concentrated on a task (ten minutes? half an hour?) and take this into account.

Physical condition
Poor physical health can also detract from your ability to concentrate. This is a fairly common culprit, attributable to factors such as:
- getting too little sleep;
- having a hangover;
- being fluey or sick.

The best remedy is simple: first rest up, then try again. But be careful not to rest too long as this can make you feel sluggish. Above all, try to stick to a normal rhythm.

Thoughts
Thoughts often have to do with things that are bothering you or creating uncertainty: that your father is in the hospital, your own frustration with yourself, that your program is different from what you expected, that you don’t feel at home in your new surroundings, don’t feel up to scratch, and so on. Try talking to someone or writing your thoughts down. This alone can be a big help. If something is really troubling you, you can always turn to a student advisor at ESA.
7. Motivation and Concentration

Students are also often distracted from studying by thoughts about things they still “need” or want to do. This can include anything from grocery shopping to odd jobs for the student association, pursuing a hobby, taking a vacation or catching up on coursework. It’s crucial that you actively switch off these competing motives when it’s time to study.

After all, it is hardly unusual to find all sorts of excuses the moment you’re ready to buckle down: “It’s four-thirty now, dinner is at six... I’d better wait till after dinner...”

**Study habits**
Concentration problems can also be tied to study habits. Things to keep in mind include:

1. Keep your notes clearly organized.
2. Make effective use of your appointments diary.
3. When studying, take regular breaks in which you actually do something different.
4. Set a concrete goal in advance: what are you going to do during this timeslot?
5. Have everything you need ready to hand.
6. Working with a pen and paper can help keep you focused.

**7.1.2. External factors**
External factors are equally important in determining your motivation and concentration. The two factors most likely to affect study behavior are described below.

**Space**
It goes without saying that if your room overlooks a busy street, you’ll have more noise disturbance. Similarly, the way your desk is positioned in your room influences your concentration. Studies have shown that a temperature of 18ºC is best for studying. Whether background music is helpful or a distraction is mostly down to personal preference. Anything that’s on your desk but not relevant to the course you’re working on is a potential distraction.

**Education structure**
The way education is structured at universities is clearly different from what you were used to in high school. Working up the necessary level of concentration when studying on your own can be tricky, especially right at the start of the first quarter. After all, exams are still a long way off so there’s not all that much pressure. In some courses there are intermediate assessments, which will push you to start on time with studying.
7. Motivation and Concentration

7.1.3. Improving your concentration
You can improve your concentration by taking steps like organizing your study environment in such a way that you’ll be less likely to be distracted, or by keeping physically fit. But concentration is also a skill that you can teach yourself by means of exercises.

1. Count each breath you breathe out, from 1 through 10, and then repeat. Do this for 20 minutes.

2. While doing a daily routine activity, such as during breakfast, concentrate fully on what you’re doing (in this case, preparing and eating your breakfast).

7.2. Motivation
Everyone knows a person who always does as little as possible in group assignments. Invariably, they arrive late and leave early. They miss deadlines and only do the bare minimum. They tend to take longer over coffee than anyone else, always complaining about their work.

We also all know someone who always gives 110 percent. They are meticulous, work hard and approach each new assignment with a smile instead of complaints. What is it that makes these two students so different from each other? The answer is motivation.

Motivated students have the will to succeed and are driven to do their best no matter what they’re engaged in. Unmotivated students are less concerned about their performance and are unwilling to do any more than is strictly necessary.

“Out of the strain of Doing, into the peace of Done.”
– Julia Louis Woodruff
7. Motivation and Concentration

7.2.1. Wat is motivatie eigenlijk?
As explained at the beginning of this chapter, the cause of a lack of motivation can be attributed to both internal and external factors. Psychology teaches us [13] that motivation is determined by a combination of personal characteristics (internal) and the situation (external) in which you’re studying. Your own personality plays a major role: are you naturally inquisitive, are you eager to belong, how do you see your future, what is your image of yourself and your abilities? At the same time, the conditions under which you’re studying also have a big impact: the course content, the way courses are taught, the value your parents attach to your academic career and a degree, your financial situation, where you are living and your roommates, things you depend on your parents for, and so on.

Clearly, motivation is not a fixed constant – your personal expectations may evolve, your financial position can change and courses differ depending on the professor teaching them. In other words, poor motivation is also something you can work to improve.

From the foregoing it should be apparent that various factors determine motivation. The motivation matrix on the right gives a basic breakdown.

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Intrinsic</th>
<th>Extrinsic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>This is a fun and interesting course and I want to earn a good grade in it. (positive emotions such as curiosity, commitment)</td>
<td>If I pass this course, my parents will pay for my vacation. (external incentive, positive reward)</td>
</tr>
<tr>
<td>= stimulating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>I know that if I don't start now I'll feel guilty later. (negative emotions such as fear, insecurity, anger)</td>
<td>I'm afraid of how my parents will react if I don't earn any credits this exam period. (external incentive, negative perspective)</td>
</tr>
<tr>
<td>= inhibiting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Your motivation for any given activity or course is always a combination of intrinsic and extrinsic factors that can complement or compensate each other: a lower level of intrinsic motivation may often be compensated by a higher degree of extrinsic motivation.
7. Motivation and Concentration

One of the characteristics of extrinsic motivation is that there is a lot you can do to increase it. But first you have to know how motivation for a particular activity actually works. This is through a process that follows the same basic stages for everyone and for all activities [14].

This process is known as the motivation chain and can be illustrated using the example of running. Imagine that you feel you need to improve your fitness and increase your endurance. Based on this need, you decide that you want to start running. You know from past experience that this has a relaxing effect and steadily improves your endurance. Consequently, you hold the expectation that running will improve your fitness. You are confident of running’s effects and this gives you the impetus to put on your running gear, head outside and go jogging in the park. You’re going for it! Once back, showered and seated at your desk, you assess the effect, and conclude that, yes, you feel better and more focused. So now you’re even more motivated to go running again, and you continue to get better at it. So much better, in fact, that you can run increasingly longer distances and even consider running a marathon!

This example shows that achieving positive results creates motivation. The same thing happens when studying pays off. By the same token, if it doesn’t, you may feel a loss of motivation. Positive results drive you to keep going, to do more and therefore continue to increase your likelihood of success. Conversely, negative results make you more inclined to throw in the towel, do less and consequently diminish your chance of success even further. The more positive results you achieve, the greater your extrinsic motivation becomes.
Select a task from this week’s study schedule for which you had trouble getting motivated. Describe each step of the above diagram as it applies to this situation.

Which step in the motivation chain was the determining factor for your lack of motivation?

Why do you think this is, and how might you change it?

7.2.2. How can I increase my motivation?
Broadly speaking, there are four factors that increase motivation – or make it go up in smoke [15]:

1. The value of the goal.
2. The specificity of the goal.
3. The likelihood that you can achieve the goal.
4. The time that passes until you can achieve the goal.

The value of the goal
How valuable is something? Value is different for everyone. Whereas for one person not passing the first year would be enough to go through the rest of life feeling a failure, someone else might have finding a girlfriend/boyfriend as their highest priority or see building a large circle of friends as at least as important as other things. One characteristic all goals share in common is that the more value you place on it, the more you’ll do (or neglect) to achieve it.

The specificity of the goal
“Finding an exciting job” may sound like a great goal, but it doesn’t conjure any clear picture. Does it mean kneading brioches in a bakery? Representing clients as a divorce attorney? Being the engineer who builds a bridge over the Atlantic? Naturally, it’s not always possible to define all the particulars of a goal, but as a rule, the more specific or concrete the goal, the more motivated you’ll be.

Course
ESA organizes courses to train students in effective study methods and habits. In the first stage the training itself builds motivation; subsequently you learn to build it yourself. For further information about these courses, see the website: https://educationguide.tue.nl/studying/study-management/stu05-approaching-your-studies/
Likelihood of achieving the goal
Normally, the greater you believe your chances to be of achieving a goal, the more motivated you'll be. If you assume from the outset that your chances of success are nonexistent, you'll behave accordingly. But someone who feels assured of finding new friends, for example, is more likely to be successful than someone who goes into college thinking they’ll be just as lonely as they were in high school.

Time to achieve the goal
Generally speaking, it's easier to work up motivation for goals that can be achieved quickly than those that are a long way off. This time horizon is the most problematic aspect of motivation and a consistent source of internal conflict. As a goal, “going out and partying” is quicker to achieve than “passing Mechanics in one week's time”. It's hardly surprising, then, that the first goal tends to hold more appeal than hitting the books...

Using the table below, formulate several goals for yourself, indicating their significance for you and how motivated you feel to achieve them. Which goals would you like to feel more motivated about?

<table>
<thead>
<tr>
<th>Goal</th>
<th>Valuable (yes/no)</th>
<th>Specific (yes/no)</th>
<th>Feasible (yes/no)</th>
<th>Realistic (yes/no)</th>
<th>Motivation (---/+/-/+++)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: passing first year</td>
<td>Yes!</td>
<td>No, what do I still need to do?</td>
<td>Yes, the year has just begun.</td>
<td>Yes, if I keep on top of my coursework.</td>
<td>++</td>
</tr>
</tbody>
</table>
Believe in yourself
Self-confidence is the foundation of self-motivation [16]. Always try to think positive and to develop a positive self-image. Avoid constantly comparing yourself to others. Sure, there will always be someone who is smarter, faster or better at something, has a better figure or is better dressed. Instead, concentrate on positive thoughts such as:

- I like myself.
- I’m a worthwhile person.
- I set high but realistic standards for myself.
- I take responsibility for my own life.
- I am attentive to others.
- I have a strong personality.
- If I really want something, I’ll get it.

Good ways to build a positive self-image include:

1. Making a list of your positive characteristics.
2. Writing down some of the compliments people have given you recently.
3. Thinking of positive things you have experienced in the past; things that you look back on with a smile.
4. Creating a résumé for yourself summarizing all your personal successes.
7. Motivation and Concentration

**Bit-by-bit approach**
This approach is particularly useful when you have a pile of work ready to do, such as solving calculus equations. Make a deal with yourself that you’ll start working on the equations and keep going as long as you viably can; at the least, you will start on one problem and make sure you finish it and understand it. After that, you can decide if you want to continue to the next equation.

**The five-minute plan**
This exercise is for tasks that you find particularly difficult to start on. Make a deal with yourself that you’ll just start out studying the material for five minutes. After those five minutes are up, decide whether you’re willing to keep going for another five minutes. You’re under no obligation, so you don’t have to. Often though, you won’t mind continuing for another five minutes once you’ve actually started.

**Make arrangements with people around you**
Recruit “allies”. Make plans to go to the gym together or study together. Try to choose someone who has less difficulty starting and persevering in the planned activity so that you’ll have an “ally” to propel you forward. Also, tell people around you about your plans. They will likely be interested to hear about your progress and ask you about it later on. Basically, they will serve as a form of social control to help keep you in action.

**Organize your work environment**
It’s common sense, yet how often do you actually make the effort? Organize your work environment in a way that makes it as “tempting” as possible to study. Clear your desk, shut off your computer or log out of social media and your email. Make sure you have everything you need ready to hand, and resist lying down on the sofa or in bed while studying your textbook.

**Rewards and/or penalties**
It may sound contrived or childish, but for some people it really works. Rewards can be as small or large as necessary. You might reward yourself with a cup of coffee after you have put in a good hour’s worth of work. Or you can give yourself a night off and just relax in front of the TV after you’ve finished what you planned for the day. If you were not able to complete the day’s task, you can also “penalize” yourself with a chore like cleaning the kitchen that evening or by not going out for a drink.
8. Studying from Textbooks and Course Readers

Soon after starting life as a student you’ll be confronted with a large pile of books and course readers that professors expect you to master for the exam after just a few weeks of lectures and instruction groups. Sometimes, your knowledge will be tested by means of an intermediate assessment, which usually takes place halfway the quartile. If you’re fortunate, the professor will make it slightly easier by handing out a syllabus specifying which topics will be covered in each lecture. Normally, however, it will be up to you to plan out what to do when.

There is a difference between mandatory and recommended literature. Mandatory literature is the literature you need to know for an exam. Recommended literature serves more as background information. If you lack time, limit yourself to the required literature.

When studying from books, students tend to make two mistakes:

1. Instead of first forming a general idea of what the book is about and how it’s structured, they tend to dive right into the first chapter or assigned reading.
2. Often, they read the book from start to finish, and then at exam time read the whole thing over again thinking this is the best way to prepare for exams.

However, there are other ways to approach studying from books that can ultimately be much more effective [17,18].

8.1. The method
In order to maximize your available time, you’ll need to take an ACTIVE approach. One method in particular is ideally suited to mastering the amount of material you will be confronted with.

This method consists of three phases:

1. Reviewing for orientation
2. In-depth study
3. Creating an overview: the helicopter view

This method is applied to both the entire book and each individual chapter in it (see illustration).

Marion Stevens, 1st year Innovation Sciences

“Initially, I thought that using the method would take more time than my old approach. That is, until I realized that the orientation and helicopter view phases take a lot less time than reading an entire chapter all over again they way I did before.”
8. Studying from Textbooks and Course Readers

Reviewing for orientation
Before starting a book, it’s advisable to get an impression of it first. Do this by:
1. looking over the table of contents, which gives a structured overview of the most important topics;
2. reading the introduction, which gives an explanation of how the book is broken down and organized;
3. reading the summary, if there is one.

In-depth study
After this orientation phase, you can start studying individual chapters. Your approach is much the same as to studying the book, but at a different level. This is explained in section 8.3.2.

Creating an overview
After having studied all of the relevant subject matter, you need to get a clear overview of what it’s all about (see Helicopter view §8.3.3). One good way of achieving this is by writing down the most important points covered in each chapter based on the table of contents but not referring back to the text itself. Doing this should give also give you a better insight into how the different chapters are interconnected. Finally, you can take practice tests to ascertain if you have sufficiently mastered the material.

Studying the chapters
When studying individual chapters, this method works most effectively if you break them down into parts. Try to break chapters down into a length that enables you to complete all three phases in their entirety in one go and without interruption. In determining the length, use the amount of time you can stay fully concentrated as your guideline. Most people are able to stay fully focused for around 45-60 minutes. How long you can stay optimally focused is something you’ll have to find out for yourself, and may also differ from one course to another.

The next step is determining how many pages you can study in this space of time. This is easy to figure out. It is always wise in any case to portion it by chapter, section or course topic. Also make sure you can complete the relevant chapter within one or two days.

“No matter how big and tough a problem may be, get rid of confusion by taking one little step toward solution. Do something.”
– George F. Nordenholt
8. Studying from Textbooks and Course Readers

8.1.1. Phase 1: Reviewing for orientation
Before studying the material in depth, try to build an impression of the topics being addressed and how they fit together. During this orientation phase, ask yourself what you already know about the topic and what you would like or still need to know about it. These factors will help you determine how you should approach the next phase. After all, you now have a good idea of where to look for important and interesting information. You’ve also gained an impression of the general difficulty. Having a clearer view of what you want to do with the material can also help boost your concentration.

A good technique for gaining an overall impression of the chapter is to read the opening and closing paragraphs. Skim through the rest of the chapter, keeping an eye out for italicized or underlined words, diagrams, illustrations and graphs. Alternatively, you can read the first and last sentences of each paragraph in the chapter.

8.1.2. Phase 2: In-depth study
In this second phase of ACTIVE study, you’ll need a pencil and paper to help you. Making notes, diagrams, summaries and so on can help you get a better handle on the material, distinguish between main points and secondary details and see how things fit together. You can also increase your overall understanding by:

- closely studying formulas, graphs and tables, which usually summarize aspects of the subject matter;
- working out example problems yourself;
- reasoning along with the examples;
- making predictions about the content.

Actively engaging with the material boosts concentration!

Tineke de Jong, 2nd year Chemical Engineering

“Adding an orientation phase and a ‘helicopter’ phase really makes a difference in that you understand the material and how it fits together better and remember it longer. This then gives me a firmer handhold when studying the next chapter, solving problems, doing lab work, group work, etc.”
In the section that follows we will consider a number of ways to use a pencil and paper when studying texts:

**a. Making information more concrete**
Some students feel it is a big help to keep a number of questions in mind while studying a chapter or book. Examples of such questions include: “What question is the author trying to answer in this section or chapter?”, “What?”, “Why?”, “How?”, “When?”, and so on. Others are helped by making abstract knowledge more concrete. Try writing down a few concrete applications of the subject matter or see if you can use your newly acquired knowledge to interpret events in the world around you.

**b. Underlining**
Underlining is a way to highlight important points in a text. By forcing yourself to seek out the text’s key ideas, you can expand your insight into what you’re studying. Also, underlining key points can help when the time comes to review the material again. When underlining, bear in mind the following:

- Don’t underline too much: limit yourself to words or phrases instead of underlining entire sentences.
- Only underline text after you have read a few sentences (e.g. a paragraph). This ensures you’ll have a better idea of where key points are being made.
- Don’t make your lines sloppy or crooked – the idea is to make the text easier to read.
- Underline using pencil. That way, you can erase it if you later discover that the section is less important than you first thought.

**c. Taking notes**
During the in-depth study phase, you can also take brief notes in your book or reader. Try the following:

- write down key words that capture the main ideas;
- convert a written section in symbols;
- adding an explanation to a difficult passage;
- formulate a brief summary in your own words;
- write down questions that occur to you;
- put question marks in the margins;
- indicate the line of reasoning by means of special characters (I, II, A, B, etc.).

**d. Compile lists of definitions**
Often, it can be useful to compile a list of key terms or concepts for each chapter. It’s best to do this after rather than while studying the text in depth because you can better assess what should be included in the list afterwards. You can then also use your list to review the material later on.
e. Compiling overviews of formulas or relations
Many scientific subjects require you to learn to apply formulas and relations to various exercises or problems. Identifying which formulas or relations are most important has major advantages since it is impossible to memorize each one and to remember in which situations they apply. This will also make it easier to pinpoint which ones you’ll need for a particular exercise. Moreover, the fewer relations you count among the core ones, the more often you’ll use them and the more easily you’ll remember them.

The core formulas or relations most worth memorizing are those that get you started when solving a problem. Use the criteria below to help you identify core relations in your textbooks, course readers and lecture notes:

- Does this formula or relation tie in with the core course content?
- How many steps are needed to derive the relation? If the derivative is long and the relation is one that is often used, record it as a core relation.
- Is the formula given the one that is most suited to using to solve problems?
- Is the list complete, with no superfluous items? Also consider these questions when you use the list of definitions.

Write down your core relations and formulas so you can easily look them up and remember them and see how they work together. Also note the validity assumptions.

f. Make diagrams
For some courses it makes more sense than for others, but in general creating diagrammatic overviews of key concepts can help you get a handle on the material. These are particularly useful when your text contains lots of terms and relationships. When making diagrams, follow the steps below:

1. Read the text thoroughly.
2. Identify terms that are explained in the text. Briefly describe what the text says.
3. Identify how these terms are interrelated.
4. Make a diagram by circling the terms and linking them via relational symbols. In the interests of clarity, bear in mind the following:
   - include each term only once in your diagram;
   - aim for a logical structure (e.g. hierarchical);
   - if necessary, combine terms to form a single new one;
   - avoid intersecting and long lines;
   - consider using colors.
5. Check the diagram and made any necessary adjustments.
8. Studying from Textbooks and Course Readers

8.1.3. Phase 3: Creating an overview: the helicopter view
This phase is the most important one of the entire method, but also the one that most people skip. After having studied a chapter in depth, students typically think something like: “Another chapter down, three more to go!”

Obviously, in-depth study is extremely important, but the material you studied will only really “stick” if you try to view it from a higher level, giving you a more comprehensive perspective. Each time you finish studying a section, ask yourself the following five questions:

1. What was it about and what were the most important points?
2. What are the main themes of the topic, in a nutshell?
3. Which formulas and relations can you recall?
4. How does this tie in with the rest of the material?
5. Where the things you identified as important also emphasized during the lecture?

It works best if you do this with your book closed, writing down your answers on a sheet of paper. The objective here is of course not to create a detailed summary, but simply to check in how far you have mastered the material.

Subsequently, you can compare your answers with your notes and with the book. If you find that you have interpreted certain sections incorrectly or even forgotten important parts, you know that you’ll need to go back and look at them again.

This phase more than any other will cut down on the time you need to prepare for your exams (and intermediate assessments) – which is crucial, considering that time is of the essence!

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g. Creating abstracts and summaries
Abstracts and summaries go a step beyond diagrams. They incorporate not only the key points but also important details. A good abstract is one that could replace your textbook.

Making an abstract takes a lot of time, however, and in many cases isn’t necessary. Usually it is more efficient to compile a list of terms or a diagram. But if you can only borrow the book for a short period, it is your best option. When creating an abstract, bear in mind the following:

- Keep it simple. If you are unsure of how the subject matter fits together, try making a diagram first.
- Don’t make the abstract too elaborate. Check if introductions or summaries in the text can be used as abstracts in themselves.
- Be organized. Note the page number or section of the book at the top or in the margin of each sheet of the abstract and use color coding if necessary.

Internalizing these new techniques takes practice. Of course, which technique(s) you use depends on your personal preference, the nature of the subject matter, exam requirements and possible time constraints.
9. Speed Reading and Mindmapping

9.1. Speed reading

*World record in speed reading: 3,850 words per minute!*

In the Netherlands, people read around 250 words per minute on average. In fact, it turns out there is a correlation between the rate of talking and the rate of reading. An Italian talks and reads faster than a Dutch person, for example, while a Texan talks and reads slower. Theoretically, anyone can learn to read 1,000 per minute without loss of understanding – it just takes some training.

It has been calculated that a person working in an office spends roughly five to six hours of their day reading. If there was an easy way to notch this up, even just from 250 to 500 words per minute, we would obviously have a major time gain.

**Important aspects [20]:**

0. Keep your body relaxed and your mind alert.
0. Formulate clear objectives.
0. Work in a well-lit environment, preferably in daylight.
0. Maintain an active posture (good chair, etc.).
0. Arrange your book to lay fully open and stay flat.
0. Determine in advance how long you want to read and how far you want to get in the book.

**Exercise**

1. Take a book, set an alarm to five minutes and read at your normal pace.
2. After the five minutes are up, stop reading and make a rough count of how many words you read (count the average number of words in the first three lines and multiply this by the number of lines per page).
3. Divide the result by five to find how many words you read per minute.
4. Now, describe out loud what you read, asking yourself the following questions: Do I feel like I have a good grasp on the material? Have I distilled the key facts?
5. Finally, read the same text again and answer the following questions: Had I really grasped it? Did I read it adequately the first time? What do I want to improve: speed, understanding, both?
9. Speed Reading and Mindmapping

9.2. MindMapping

What is mindmapping (MM)?
MM is a technique to help you maximize your brain function, process more information, get a better overview and learn faster. In essence, it helps you develop strong(er) associations using images and links [21,22].

When can you use it?
You can use MM when taking notes, reading a book/report, preparing a presentation, brainstorming or simply to boost your creativity.

What do you need?
A large sheet of paper and pens/pencils in different colors.

How does it work?
1. Take a blank A4 sheet and lay it horizontally.
2. Write down your theme in the center, using at least three and no more than five colors.
3. Draw fluid lines extending out from the theme.
4. Draw connections between these lines.
5. Use a single word and symbol to designate each line.
6. Print in capital and block letters.
7. Imagine your MM as a clock face: start at 2 pm and continue clockwise.
8. Use images, symbols and color dimensions.
9. Give your imagination free rein.

@ Exercise
Make your own mindmap on the theme of studying. Use Google to search for additional information about MM.
10. Solving Problems

10.1. Working method for problem-solving exercises
An active approach is essential when doing problem-solving exercises. You must consciously ask yourself how you should approach the question as many of those that you’ll encounter during your studies can’t be solved by “just trying something out and seeing what happens”. Moreover, in most cases you won’t have any step-by-step instructions to guide you toward the answer. Instead, you’ll have to determine the steps needed to find the solution yourself.

It can help if you take a systematic approach [18]. This will guard against errors and also score you more points in exams since, with these questions, the method by which you tried to solve the problem is often worth more points than the final answer. The idea behind taking a systematic approach is not to follow a complex procedure but to keep a clear view of the solution process and be aware of what you’re doing at each step along the way.

What is the purpose of doing problem-solving exercises?

1. Problem-solving exercises require you to put theoretical knowledge into practice. Doing such exercises helps you learn the possibilities and constraints of a component of the subject you’re studying.

2. Problem-solving exercises are a good way to familiarize yourself with the subject matter, helping you remember it better while also giving you greater insight into the material.

3. Exams are often made up in large part of problem-solving questions, so practicing these represents a vital aspect of exam preparation. Doing practice exercises also gives you an indication of whether you understand the material as it will appear on the exam.

Phase 1:
Understanding the problem

Phase 2:
Designing a solution plan

Phase 3:
Carrying out the solution plan

Phase 4:
Reviewing the outcome
10. Solving Problems

Phase 1: Understanding the problem
This phase is about developing a clear perspective on the problem. To do this, it’s particularly important that you carefully read and reread the task. A common error in this first phase of finding a solution is to miss out certain information or to interpret the data incorrectly. During this phase you want to find answers to the following questions:

What are the data? What is being asked?
A good way to approach any problem-solving question is to ask yourself what data are being presented, if the data are sufficient, if any may be superfluous or even in conflict with other data and, finally, what the precise question is.

What are the parameters?
Does the equation already tell you the value of an unknown under specific conditions? Can you create a picture to clarify all or a part of the equation?

Can any of the words, concepts or characteristics be converted into symbols? Avoid doing this with numeric data as making any single numeric adjustment can throw the outcome into confusion. Also, numbers are more prone to errors than symbols; slips of the pen and miscalculations are easily made.

Phase 2: Designing a solution plan
It goes without saying that the most important and also most difficult step toward solving a problem is figuring out how to get from the data you have to the data you want. You will need to be able to envision the path to that solution as a clear series of steps - steps you can determine and understand on your own. It’s important that you don’t attempt to grasp or to solve the entire problem all at once; instead, try to answer the following questions, in order:

1. Do you recognize the problem?
After you have rendered the problem in broad mathematical form, ask yourself the following questions:
   “Have I ever seen this problem before?”
   “Have I ever seen this problem in a different context?”
   “Have I ever solved a problem that in any way resembled this one?”

There are two possibilities:

a. You recognize the problem based on your experience solving various sorts of problems in the past.
If you can recall having solved similar problems in the past, you can use this experience and get straight to work. This also means you have an idea of its difficulty.

b. You don’t recognize the problem.
Is the problem totally unfamiliar? Don’t panic! After all, all you need to do to solve this problem is to apply the theories that you already know.

“The secret of getting ahead is getting started. The secret of getting started is breaking your complex overwhelming tasks into small manageable tasks, and then starting on the first one.”
– Mark Twain
10. Solving Problems

2. Which parts of the theory do you need to use (theorems, formulas)?
Can you restate the problem in a simpler form? When restating the problem, only include the essential data and the data being requested. Determine whether the problem as it is stated can be reformulated in mathematical terms.

3. Can you break the problem down into sub-problems?

4. Can you solve any components of the problem or sub-problems?

5. Have you accounted for all the data and limiting problems?
Draw up a plan for finding the solution. Normally this will entail various steps or components.

Go back and consider the problem and your method for determining the solution once more:
- Do you need all the data provided?
- Are there particular steps at which you’ll need specific data?
- Are all the steps in their correct sequence?
- Which steps might throw up difficulties?

6. Can you come up with a rough estimate of the answer?
You can try to estimate the outcome based on the data you have or on other parameters. Often, you can draw conclusions about the scale and sign of the answer even before making any calculations, based simply on past experience or theoretical knowledge.

Phase 3: Designing a solution plan
This is the phase in which you actually solve the problem, working step by step. Keep everything in formula form as much as possible, not filling in numbers until the end. As you’re working ask yourself:
- Is each step carried out correctly?
- Can I see if the step is correct?
- Can I prove that the step is correct?

Petra de Brouwer, 2nd year Computer Science
“I’d always assumed that the problem-solving process was largely down to a mix of imagination and luck and that there was little I could do to influence it. Plus, I could hardly see my way to any kind of systematic approach through the forest of data and possible equations. But by taking it step by step and using a solution plan, I learned that it has nothing to do with luck.”
10. Solving Problems

Phase 4: Reviewing the outcome
This phase asks you to think critically about what you did in the previous phase. A common error people make is not to take the time for critical review. In essence, this phase entails going back through the three previous phases a second time. If you run into something that doesn't line up, figure out why and exactly where you went wrong in order to avoid making the same error again.

Questions you might ask during this review phase include: “Have I solved the whole problem?” and “Can I verify the outcome?” You might do a dimension analysis, a comparison with your estimate, or consider borderline or limiting cases.

It can be useful to determine whether you could have obtained the same result using a different method. On seeing the result, you might realize that you could have solved the problem by a different, and possibly faster, route. If the result is very different from your preliminary estimate, find out why.

What have you learned?
Once you have solved a problem correctly, take the time to establish what type of problem it was, which method you used to solve it and different possibilities you encountered during the process. This form of review is useful because it reduces the likelihood that you will have to start from scratch if you find yourself facing a similar problem in the future (and risk making the same errors).

Summary
A large share of your study material and exams will consist of problem-solving exercises. Therefore, it is essential that you practice using methods that will enlarge your chances of obtaining a good solution.

Before you actually get down to solving a problem, make sure you thoroughly understand it. Next, try to devise a plan of attack for solving the problem. Solving it is then a matter of carrying out your plan. After obtaining a solution, go back and take another critical look at your work, correcting any errors of reasoning and miscalculations as needed.

1. Understanding the problem
   (data, parameters, picture)

2. Designing a solution plan
   (recognizing, breaking down, estimating)

3. Carrying out the solution plan
   (checking, comprehending, calculating)

4. Reviewing the outcome
   (the correct answer to the question)
11. Attending Lectures and Instruction Groups

The amount of material first-year students have to get through means you're more likely to have too little time than too much. Using your time as efficiently as possible is essential. This is easier said than done, however; students often get behind and end up pressed for time – whether due to unnecessarily repeating steps or because of constantly having to do work over that wasn't done properly the first time around.

Mastering a subject requires a combination of attending lectures and studying textbooks and/or course readers on your own [23].

Lectures will often provide explanations and/or supplements to the reading material that you may later need to know for the exam. As such, lectures are an important source of information and well worth attending. In some cases, lectures are recorded in the form of “video lectures” that you can (re)view on the Internet.

11.1. Attending lectures

Attending lectures does not mean simply sitting in a lecture hall and getting the gist of what’s being said. Quite the reverse: it means listening intensively and actively. You need to not only follow the professor’s line reasoning but also, if possible, try to see where he or she is going and extract answers to your own questions.

If you find yourself having trouble concentrating during lectures, try the following tips.

- Make a conscious choice to actively focus on the lecture. After all, if you’re just going to read the newspaper, you may as well stay home.
- Make the effort to be there on time so you don’t miss the introduction. Otherwise, it can be difficult to pick up the thread of the topic being explained.
- Sit at the front of the lecture hall. It’s more likely to be noisy in the back and you may also see less.
- Leave your laptop, cell phone and other distractions at home (or at least in your bag).

Lecture Tip 1

Some professors give an overview of the topics to be discussed at each lecture at the very beginning of the course. They may also conclude each session by announcing the topic of the next lecture. If this is not the case, ask the professor to do so.
11. Attending Lectures and Instruction Groups

Taking efficient notes
It’s important to limit yourself to the main points and keep it brief. Don’t automatically copy down everything the professor writes on the board – certainly not if you can also find it written out in the course reader.

1. The objective when taking notes is to help you study for the exam. The exam requirements should be your guide, so try to find out what they are at the beginning of the course period. Then ascertain how the course material links in with the exam. If you know that examples and illustrations used by the professor may reappear on the exam, it is useful to note them down. Also see if you can get old exam questions, though you should check that they are still representative of current exams.

2. Be selective and only write down crucial information (what you need to know for the exam). Active note-taking means: listening to what the professor says, thinking about what he or she says, determining what is important, less important and unimportant, deciding which of these things are worth writing down – if possible, in your own words – and all the while continuing to listen to what the professor is saying, thinking about what he or she is saying, determining what is important… and so on.

3. Listen for verbal cues such as: “In conclusion...”, “To summarize...”, “The most important thing is...” and “Basically, this means...”, etc. Other cues to look out for are summaries presented in the form of “First…, Second…, Third...” and changes in pace or intonation.

4. If the professor gives no indication at all about what is important, you can ask him or her to do so during the lecture.

5. If you do include secondary details in your notes, be sure to clearly distinguish them from the main points. You can do this visually, for instance by reserving the right-hand side of the page for details.

6. Leave enough space for additions or corrections that you might wish to add later. Since you want your notes to be easy to use, define a clear structure and stick to it.

7. When including your own opinion in your notes, make it readily identifiable as such, the same way you did with secondary details. For example, put them in the left-hand (blank) page of your notes. In any event, be sure to keep your opinion separate from the professor’s elucidation.

8. Always try to write down what the professor says in your own words. Practice doing this as concisely as possible. Using abbreviations and symbols can also be helpful because it saves time; however, do make sure you use them consistently.

Lecture Tip 2
Some professors post their lecture slides on the Internet, which you can then print out as “notes”.

Lecture Tip 3
Compare your notes with those of your fellow students to check if they all follow the same main lines, among other things.

Lecture Tip 4
Make sure to have your lecture notes to hand during instruction groups so you can refer to them and make any additions and/or corrections.
11. Attending Lectures and Instruction Groups

11.2. Attending instruction groups
Most of the courses you take in your first year also have scheduled instruction groups. There is a good reason for this: exams for these courses are made up mainly of problems you’ll have to solve. Instruction group meetings give you the chance to practice doing lots of problem-solving exercises. They also provide an opportunity to ask the instructors questions. Two things are crucial to getting the most out of instruction groups: advance preparation and assimilation afterwards. Attending instruction groups is about more than just copying out sums; it requires active participation on your part if you want to benefit.

Instruction groups can take different forms. These forms and their defining characteristics are described in the overview below.

<table>
<thead>
<tr>
<th>Instruction Group Format</th>
<th>Attendance means...</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. The instructor assigns practical exercises that students work on during class. You can ask questions during the group and the assigned exercises are usually discussed at the end.</td>
<td>In this form, most of the activity takes place during class time. If you go to these meetings, make an effort to work out the problems before hearing the actual answers. That way, you can immediately resolve any steps that are unclear.</td>
</tr>
<tr>
<td>B. The instructor uses the entire class time to demonstrate practical exercises: he/she works out the problem and you copy it out.</td>
<td>Students have a tendency to assume this form of instruction is relatively ineffective. And that’s true if you mindlessly copy out the solutions. However, if you reflect on what the instructor is saying and listen to the explanation, you can learn plenty. Moreover, you’ll always have a correct calculation to refer to when working out problems yourself.</td>
</tr>
<tr>
<td>C. Like B, except that the instructor gives students the exercises to be demonstrated before the actual group meeting.</td>
<td>If you complete the exercises at home and get the answers correct, you may still wish to go to the group meeting to ask any questions. You may also be able to have the instructor review your calculations. Do make sure that you used the correct method and notations in your calculations. Professors tend to have a standard method for solving problems that they also expect you to use on the exam.</td>
</tr>
<tr>
<td>D. The instructor calls on a student to do the assigned exercise on the board.</td>
<td>This approach is similar to that in C. Obviously, the student who is called on need not have the answer right. You can take this into account when making any corrections in your own work.</td>
</tr>
</tbody>
</table>
# 11. Attending Lectures and Instruction Groups

The following summary overview is designed to help you make the most of your attendance at lectures and instruction groups.

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Instruction</th>
</tr>
</thead>
</table>
| **Step 1: Orientation**  
You can get a handle on upcoming lectures by:  
1. checking the discussion topic of the last lecture;  
2. looking at the topic scheduled for the next lecture;  
3. marking key points in the new material yourself;  
4. taking a glance at the material to be covered; and  
5. marking elements of the material that you already know (prior knowledge). | **Step 1: Preparation**  
No matter what the form of instruction, it’s always a good idea to look over the material in advance. Write down any questions you have; this ensures you won’t leave the class thinking: “Now what was that thing I wanted to ask?” |

**Step 2: Attending lectures**  
Try to follow the professor’s line of reasoning. While listening, check whether:  
- your basic distinction between main points and secondary issues corresponds with the professor’s explanation;  
- aspects of the material that seemed difficult are becoming clearer;  
- any questions you had during the orientation step are being answered. This approach alone will already help boost your concentration. You can focus it even more by combining listening with taking brief notes. | **Step 2: Instruction Groups**  
Like so many aspects of your degree program, attending instruction groups is only worthwhile if you make an active effort. As a rule, this means not only copying everything out but also engaging in the discussion and asking questions that you’ve been saving for class or that occur to you. Try to find out in advance if you will be given the steps to working out the exercise solutions in class. If you have these, you know you can concentrate on the essence of the exercises. |

**Step 3: Assimilation**  
It’s always a good idea to review the material discussed during lectures as soon as possible after you get home. The lecture is still fresh in your mind, which will make studying easier. Use your notes, but don’t spend too much time rewriting them. Doing practice exercises at home is one component of assimilating the lecture content, alongside instruction in groups meetings for science and math courses. | **Step 3: Assimilation**  
If you find yourself having difficulty with certain exercises during the instruction group, it’s crucial that you work through them again as soon as possible afterwards. If you don’t, you’re likely to forget the calculation method faster than you might think. Relearning it for the exam will then take that much more time. |
11. Attending Lectures and Instruction Groups

11.3. Attending laboratory courses
This section describes steps you can take to get the most out of lab courses.

Preparation
1. Keep a lab notebook (and/or an Excel file) in which to record notes. Don’t use sheets of loose leaf paper as these are easily lost.
2. Carefully read through the description of the experiment and note down anything you’re unsure about.
3. Look at how the formulas were obtained and whether you understand their derivations.
4. Write down the important quantities you’ll need for the experiment, together with the units, and also take care to note all of these down when doing the experiment.
5. Look up whether you’ll be working with hazardous substances in advance so that you can take appropriate measures should anything go wrong. Record all of this information clearly in your lab notebook.
6. Check whether you understand the reaction mechanisms and if you are able to identify them.
7. Always take notes during the preliminary discussion about the experiment.

Lab class
1. The lab supervisor and lab assistant are there to help you, so don’t hesitate to ask if anything is unclear or if you’re unsure about how to operate equipment.
2. Record data in your lab notebook in a clear and consistent way. For example, you might record measurements taken during lab class on the right-hand page and data you’ve looked up on the left-hand page.
3. Also clearly indicate the date on which you did the experiment.

This will ensure you have all the data you need if you have to submit an experiment report or measurement report and make writing up the report a lot easier. Remember, your lab notebook is not for your professor, but for you!

Experiment and measurement reports
1. Stick to the same organizational format as used in the instructions and adopt it as your own.
2. Work systematically and structure your report (for example by adding a table of contents).
3. Compile your measurement or experiment report as soon as possible after completing the experiment, when you still know what it was about and the obstacles you encountered. Moreover, by not waiting you also won’t risk running out of time, since reports always have to be handed in before a certain deadline (normally immediately before exams). If you leave it until the last minute, you’re likely to have difficulties preparing for exams.

Follow-up discussion of experiment and measurement reports
As soon as you have handed in your report, schedule an appointment to discuss it. Make notes on any errors you made, which is not only a good way to learn from mistakes but is often the best way to see where your real problems lay, things you may not have considered, and so on. Plus, it provides a reference on how the experiment was conducted that you can always refer to later.
12. Examinations

If you want to earn credits and – someday – your degree, you’ll have to take quite a few exams along the way. There are several problems you might run into during an exam that can prevent you from passing it. Common problems include: running out of time, questions that are different from what you’d expected, the exam is harder than you’d expected, making too many sloppy mistakes, getting stuck on questions and not being able to figure them out, getting struck by a case of nerves, and so on.

In some cases you may find yourself dealing with factors that have an adverse impact on your exam results but that you yourself have no direct influence on (an exceptionally difficult exam, a curriculum that exceeds your academic capacities, exam anxiety, etc.). In most cases, however, such problems originate in your approach to exam preparation and to taking the exam itself [24].

12.1. During the lecture period

Students usually find it all but impossible to study the material to be covered on various different exams to any great depth during the lecture period. A better objective at this point is to “keep up” with the subject matter. “Keeping up” means reviewing all of the material during the lecture period to make sure you understand it. It does not mean memorizing everything straight away; the most important thing is getting a good overview of the subject and understanding what it’s about.

Also keep what is known as an “error analysis” of all your assignments, which basically means identifying causes when you are unable to solve a problem or you do it incorrectly: was it due to sloppy mistakes, logical errors or an inadequate grasp of the underlying theory?

If you are consistent in keeping this record you’ll eventually be able to pick out patterns in the types of errors you make and in which areas. Knowing this will enable you to study more effectively: once you know where your strengths and weaknesses lie you can invest more effort in those weaker areas.

Note: Most subjects are assessed not only by an exam. Often there are also a number of assignments or intermediate tests that determine your final grade. So do not focus solely on the exam, because you need to pass the assignments and intermediate tests as well as the examinations [19].

“Talk doesn’t cook rice.”
— Chinese proverb
12. Examinations

12.2. Planning for exams
To save yourself from making the unpleasant discovery that you don’t have enough time to thoroughly study everything you need to before the exam period, draw up a general exam planning schedule several weeks (three or four) in advance. In it, specify how much material (number of pages, theory, notes, number of exercises, old exams) you have to study each week (or day) and how much time you expect this to take. Also plan in time for going over material a second time and any time you need to discuss problems with fellow students or a professor.

In order to make a realistic exam planning schedule, you’ll need to have certain information:

- Which material do you need to know for the exams (course readers, assigned exercises, etc.)?
- How much is this in terms of the number of pages or exercises?
- How will the exams be administered and hence what approach should you take to studying the material (focus on main points only or also details, open questions or theory, etc.)?
- Determine which exams you want to take in the upcoming exam period and on which days they are offered.

You can find a great deal of information about the content of exams through the TU/e’s digital learning and working environment, Canvas and Osiris. When consulting them, ask yourself the following:
1. How much of this material do you already know, and how well?
2. How fast do you work (how many pages of theory can you do in an hour, on average, and how many exercises)?

For each course, determine what you still need to do to be fully prepared to take the exam and estimate how much time you will need for this. Factor in:
- new material you’ll need to study
- practice exercises
- exam questions.

Check if you have any other time-consuming commitments in the period up through the end of exams. These are also important to factor in when creating your planning schedule.

Make a conscious choice whether you will register for an exam. Please note: in the Bachelor College you’ll be registered automatically, but in the Graduate School you have to do it yourself!

If it’s not realistic to think you’ll pass the exam, then make sure that you’re not registered for that particular course and concentrate on the ones you think you can pass!

Exam Tip 1
Figure out what works best for you: working through one entire course and then moving on to the next, or alternating between different courses.
12. Examinations

Of course, it can be tricky to specify exactly what you’re going to do when over the next four weeks. Simplify things by first making a general schedule like the one shown below. For each course, distribute the theory and practical exercises on your list over the remaining weeks.

<table>
<thead>
<tr>
<th>Course</th>
<th>Week 6</th>
<th>Week 7</th>
<th>Week 8</th>
<th>Exam week 1</th>
<th>Exam week 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear algebra</td>
<td>IG 1, 2 &amp; 3 review</td>
<td>IG 4 &amp; 5 review</td>
<td>IG 6 &amp; 7 review</td>
<td>Take practice exam</td>
<td>Exam</td>
</tr>
</tbody>
</table>

Once you have a general plan of action, you can make it more concrete at the end of each week by filling in the details of your schedule for the next week. Plan the details of each day as specifically as possible. For example: “On Monday of week 6 I’ll review chapters 1-6 and do the practice exam from November 2017. I’ll assign four hours for reviewing the subject matter, three for doing the exam and one for checking the exam.”

Include sufficient buffer time. This means not scheduling anything for a whole or half day, leaving it free for work that may spill over from other days. If you do stay on schedule, the buffer will be a study break. But if you do run behind, then the time will come in useful to catch up. Basically, having a buffer helps you avoid time stress.

12.2.1. Adjusting your exam planning schedule

Almost inevitably, things will come up to interfere with your schedule that you cannot anticipate, such as illness, unexpected extra work or unexpectedly difficult material, etc.

By planning days off (buffers) into your schedule, you can guard against problems if you end up needing more time. Incidentally, you might also find you can adjust your schedule because you have time left over. A planning schedule is never set in stone; in the likely event it needs adjustment, there’s no need to panic.

If you’re registered for an exam but end up not going, realize that it does count as an attempt.

In principle, you are allowed three chances to take the exam for each course. If you don’t pass any of these for whatever reason, you’ll need to contact your academic advisor, who will determine what your remaining options are.

Exam Tip 2

Make a point of catching up on instruction group assignments you may have put off.
12. Examinations

12.3. Studying for exams

When studying specifically for exams, it’s important to find out which parts of the subject matter you should focus on. (Don’t try to study everything equally and to understand everything down to the smallest detail; not only is this unnecessary, it’s impossible.) Find out where the exam questions will be coming from (e.g. syllabus, book, labs, lectures, etc.) and what types of questions you can expect.

As already discussed, it is essential to gather all possible information about what type of exam you can expect before you start studying for it. After all, you’re spending the entire quarter learning the topics that will be examined.

Also try to find out which professor is responsible for putting together the exam questions. If you are taking a lecture or lab taught by that professor, he or she is likely to indicate which elements and approach to the subject he or she deems important. Further, discuss possible approaches with fellow students from time to time and far enough ahead of the exam.

If, despite these efforts, you are unable to find out just what you need to study for an exam, or which components of the material are most important, you can also consider talking to the professor. You want to get something out of this meeting, so prepare for a serious discussion. Ask as targeted questions as you can, possibly making notes in advance to remind yourself. If a student comes with vague questions like “What do I need to do for the exam?”, professors will usually not have the patience to sit down and pinpoint which topics you don’t know.

Making adjustments

As long as you still have spare time in which to study, such as during free weekends, then making adjustments shouldn’t present a problem. Where it gets tricky is if you don’t have any time to spare. At this point, you’ll have to make some choices.

Firstly, you’ll have to determine what weighs heaviest and then give that priority. This will mean compromising on or sacrificing lower priorities. Can you give up your weekly workout for a month? Can you curb your social life for a little while? You can also consider to what extent you need to study all the exam content with equal intensity. Perhaps it would suffice to skim through some of the chapters; obviously you won’t master the details this way, but you can pick out the main themes, and that’s better than studying only half the material in depth and ignoring the rest.

It can also be a good idea to set the theory aside and concentrate on doing problem-solving exercises. This will automatically point up any gaps in your theory on which you should spend extra time.

Also, remember that you can learn a lot from planning errors.

Exam Tip 3

If your planning schedule doesn't work out as you expected, don’t make the further mistake of assuming that all planning is pointless.
12. Examinations

12.4. Practice exams
To successfully pass an exam you need to not only have a good grasp of the subject matter but also be able to prove it under conditions that are different from what you’re used to.

To begin with, exams are made up at least in part of questions of greater complexity than what was presented during instruction groups. In terms of topic, they may appear in a different sequence than what you studied in your books or course reader. Moreover, you’ll need to answer/solve the questions with few or no aids and within a limited space of time. Finally, when working out problems on an exam, you often have no immediate assurance that what you’re doing is in fact correct.

All of these factors can adversely affect your performance if you haven’t accounted for them in your preparation. This is where doing a practice exam can help, by:
- practicing solving problems of the type and level you can expect on the exam;
- practicing solving these problems without recourse to your reader or a fellow student if you can’t get the solution straight away;
- practicing solving these problems within the time limit set for the exam;
- preparing in a way that is as meticulous as possible and spending additional time on common errors you made over the past quarter (error analysis).

In view of all this, it can be very useful to simulate the exam situation once or several times. Simulation basically means you do an old exam under conditions that resemble the real exam conditions as closely as possible (level of difficulty, time limit). It gives you a good idea of how you perform under these conditions and where you might need some extra practice. To practice oral exams, ask a fellow student to help so you can practice formulating your answers verbally. Please note that the examinations before 2012 could be different from the exam you can expect.

Some courses also organize practice exams. Use this opportunity! Simulating a real exam is also a good way to get over anxiety about taking exams, since this often derives from a lack of confidence in your knowledge and/or your ability to express or apply it.

Exam Tip 4
A planning schedule should be dynamic, not static. Expect to have to make adjustments, and set aside time for this!

Exam Tip 5
Completing one or two old exams in full, working within the set time limit and without using your reader or notes, is always useful. At the least it gives you an indication of how well you understand the subject.
12. Examinations

12.5. Taking exams
In the period immediately before the exam, it is important to:
- be informed about a number of practical aspects;
- have a good general understanding of the material;
- feel physically and mentally fit.

Some practical aspects to bear in mind when taking an exam are:

1. Be sure you know in advance when (the date) and where (the building and room) the exam will be administered and how much time you’ll be given.
2. Arrive in good time so you can start the exam in a peaceful frame of mind.
3. Have an accurate watch to hand so you can keep track and make the best use of your time.
4. Know in advance what you need to (and can) take with you to the exam, such as writing implements (spare pen), set square, calculator (charged up), books, tables, student card, laptop and so on. Assemble these items on the evening before the exam in order to avoid forgetting anything in your rush to leave.
5. Note that graphing calculators are not always permitted at exams.

Of course, a good general understanding of the material depends in the first place on a timely, well-distributed and thorough study of that material. Don’t make things any harder than they need to be by, for example:
- waiting until the last moment to study a completely new section;
- pulling an all-nighter right before the exam; or
- waiting until right before the exam to share questions with fellow students.
Doing any of these will only make you anxious.

The key to being in good shape for an exam is ensuring your daily rhythms (sleeping, eating, studying, relaxing) are not overly disturbed during the week prior to the exam.

- Aim for a good balance between exertion and relaxation.
- Getting enough sleep makes it possible to study more intensively and actively the rest of the time.
- Always take the time to eat healthy.
- Avoid drinking too much caffeine and alcohol. Heavy smoking can also make you sluggish.
- Get enough exercise.
- Make a point of doing something relaxing at least one hour before going to bed. This will help your brain wind down and ensure a better night’s sleep!

Exam Tip 6
Start testing yourself with practice exams well in advance. Doing this will give you an immediate insight into how well you can actually reproduce what you’ve learned and hones your exam-taking skills.

Exam Tip 7
Don’t forget to control whether you’re signed up for your exams no later than one week before the exam period commences!
12. Examinations

12.2.2 Written exams

1. Orientation
The first thing to do after the exams have been handed out is not to dive straight into the first question. Instead, take a moment to calmly get your bearings. Carefully read through the instructions, look how many questions there are, what type of questions and the level of difficulty, the topics covered and how many points each question is worth.

2. Het maken van een plan voor het beantwoorden
Determine roughly the amount of time you think you’ll need for each question and the order in which you want to answer them. It’s advisable to start with the easiest question. This can help boost your self-confidence and reduce your anxiety.

3. Answering the questions
1. Read each question thoroughly. Take careful note of the instructions accompanying the question: to “summarize” is not the same thing as to “discuss”, and to “define” goes deeper than to “describe”. Make sure you understand the precise nature of the difference between instructions telling you to: compare, define, describe, discuss, summarize, critically assess, explain, prove and so on.
2. Work systematically. If a question or problem is more complex, start by making a structural diagram of the solution (the answer) on scrap paper and only then write it out. Also see Chapter 10 of this guide.
3. Work efficiently and make sure you’re only answering the question being asked.

4. Formulate your answers to be lucid, clear and concise. Take care not to skip any (important!) steps.
5. Write clearly and legibly (the professor has to be able to read it) but don’t make your handwriting any nicer or neater than it needs to be (which takes too much time and is not a factor into your grade).
6. Balance out the time you spend on each question. Do your best to stick to the plan you made for answering questions and don’t take too long on any you can’t figure out. Instead, skip these questions and go on to those that are easier to solve!
7. If you do skip a question, indicate this clearly on your answer sheet.

If you finish before the time is up, use this time to calmly review your work. There’s no award for leaving early.

4. Reviewing and checking your answers
- Have you answered all of the questions in full?
- Have you followed the directions for each question?
- Have you forgotten any elements?
- Have you made any calculation errors or sloppy mistakes? Also check all the symbols and units and do a dimension check.
- Have you interpreted all the questions correctly?
- Have you numbered all your answers correctly?
- Is your name printed on all your answer sheets?
12. Examinations

12.2.3. Multiple choice exams

1. Developing an exam strategy
Similar to an exam with open questions, your first step should be to get a general sense of the exam and then determine a strategy. One thing that’s essential is to read the instructions explaining how points are allocated:

- If points are subtracted for incorrect answers, you should be extremely cautious about guessing, and may be better off not doing so at all. If no points are subtracted for incorrect answers, then you should always guess, even if you have no idea what the answer is.

- If you are asked to provide a confidence score, check how many points a correct and an incorrect confidence score are worth. The optimum confidence score to assign will always vary depending on the individual and the difficulty of the question. The important thing to bear in mind when indicating a score is whether you are more likely to overestimate or underestimate your own knowledge.

- Most multiple choice exams award the same number of points for each correct answer. For this reason, it is worth doing all the “easy” questions first, instead of getting stuck in the “difficult” ones.

2. Answering the questions
1. Start at the first question and proceed through the exam in the order the questions are listed. However, don’t spend too long on any questions you need to think about. Skip these for now, making a note in the margin, and go back to them later.

2. Read the questions thoroughly. Watch out for critical words such as “not”, “so that”, “because” and so forth. Think through questions that are phrased in the negative and also watch out for double negatives.

3. Don’t select an answer until you have considered all the options.

4. When you come to the end, go back to any questions you skipped. Cross out the least likely answers. If you still don’t know which answer is correct, you can hazard a guess between the remaining alternatives. But don’t guess if doing so can hurt your grade in view of the scoring method (e.g. if points are subtracted for incorrect answers).
12. Examinations

3. Reviewing and checking your answers
Broadly speaking, the same advice applies here as to open question exams. Key things to bear in mind with multiple choice exams are:

- Be cautious about changing your answers and only do so if you're absolutely certain that the one you chose first is wrong. Usually, the first answer is best.

- If you suspect the answers will be processed mechanically, check that you have followed the instructions precisely (e.g. “check” versus “shade” the box). After all, computers can't distinguish good intentions.

- If you are using a loose leaf answer sheet, check that your answers match up with the questions.

12.2.4. Open book exams
Some courses allow you to use the textbook or course reader to answer exam questions. “Open book exams” are a commonly used format for testing students’ knowledge. When taking an open book exam, remember the following tips:

- Don’t underestimate open book exams. It’s a good idea to study the book carefully beforehand as there won’t be time during the exam to try to figure out where in the book you might find information to help you answer the question. This will only stress you out more.

- Unlike written exams that don’t allow you to use books or readers, open book exams usually do not have questions asking you to reproduce what you have learned. Normally, you’ll be expected to make connections or come up with applications. You won’t find these in the book! Practice taking old exams so that you’ll know what types of questions to expect.

- After studying the book or reader, consider making your own table of contents or brief summary of each chapter (in a diagram). That way, you’ll have your own convenient system for looking up topics and ensure you don’t lose any time trying to track down information.
12. Examinations

12.2.5. Oral exams
Some courses are concluded with an oral exam. The following tips can help you when taking an oral exam:

- Don’t regard the examiner as an enemy, which will only make you prey to anxiety. The examiners are not out to fail students; they mainly want to ascertain how much you know, and some even enjoy drawing you out.

- If the examiner asks a question you don’t understand, don’t scrabble for an answer; instead, ask him or her to explain.

- Don’t feel obligated to fire off an immediate answer. Just as during a written exam, it’s perfectly fine to first think about how you want to answer. If you do this, you’re also likely to be calmer and even give a better answer to the question.

- A good strategy is to keep the dialogue focused for as long as possible on topics that you know more about, and in so doing keep areas you are weaker in out of range. When you know less about the topic of a question, be honest and admit it instead of wasting time in a demonstration of ignorance.

- Occasionally you may also be able to lead the examiner away from a topic you would rather avoid and toward to another topic. For example, you might expand on a particular idea you found exceptionally interesting.

12.3. After the exam
One valuable and excellent way to learn how to tackle an exam and, in the event, why you failed an exam, is to do a post-exam analysis. If offered, you should always take the opportunity to consult and discuss your exam with the professor. If your exam grade is very different from what you had expected, try to discover the reason for this.

Find out what types of errors you made (sloppy mistakes, logical errors, insufficient mastery of the subject) and in which part of the exam or specific topic you made the most errors. Most importantly, try to ascertain why you made those particular errors so that you can take steps to avoid making them again in the next exam.
12. Examinations

12.4. Summary

A. Preparation during the lecture period and final weeks
During the lecture period:
- Review for understanding, go through the material, distinguish main points and secondary details and build an overview of the subject.
- Error analysis

Planning for exams:
- Which material (course readers, etc.)
- How much (pages, exercises)
- Level of difficulty
- Exam format
- Time needed for study

Studying for exams:
- Study the material based on the question format (type, level) you expect to be used on the exam.

The practice exam:
- Simulate taking the real exam, applying the same level and time constraints.

Make sure you balance out studying with enough sleep and relaxation!

B. Countdown to the exam
Practical factors
- Where and when will the exam be held, what time does it start and how long will you have?
- Arrive on time so you can pick a good seat.
- What are you required/ permitted to take into the exam with you?

A good overview of the material
- Don’t pull an all-nighter right before the exam.
- Don’t discuss any further questions with fellow students.

Keep yourself fit
- Get enough sleep and relaxation.
- Eat healthy and regular meals.

C. During the exam
Types of exams:
- Written
- Oral
- Open questions
- Multiple choice questions
- Open book

Exam strategy
1. Glance through (orientation):
   - how many questions;
   - what type;
   - difficulty;
   - scoring.
12. Examinations

2. Plan out your approach to the questions:
   - sequence;
   - time distribution.

3. Answering the questions:
   - Read the question thoroughly.
   - Work systematically.
   - Work efficiently and make sure you’re only answering the question being asked.
   - Formulate your answers to be lucid, clear and concise.
   - Write legibly.
   - Balance out the time you spend on each question.

4. Review and check:
   - Only change an answer if you know why your first answer was incorrect!

D. After the exam
Do an error analysis and ask the professor to review the exam with you.

13. Conclusion

We hope this guide has provided you with proper insight into the different things you can do to learn and study as efficiently as possible. Naturally, it’s up to you to find out what works for you (and what doesn’t).

If you have any further questions or comments or would like to talk to someone about study techniques, please feel free to contact ESA: esa@tue.nl.

Enjoy your studies!
References

Courses

Images


P5: Caramba (z.j.). *Leercirkel van Kolb* [online afbeelding]. Gedownload op 26 januari 2016, van http://www.caramba-online.nl/leercirkel.html


