McGill Physics TA Reference Handbook

2021-2022

Version 1.0

Compiled by the McGill Office
of Science Education,
McGill Physics Department,
and MGAPS

This is a living document, so we welcome any suggestions you have on how to improve, be that additional resources, explanations, references, or tools. We want to make your job easier and the path to you and your students' learning experience as smooth as possible.

If you have any comments/feedback, please contact the current MGAPS TA Officer: benjamin.dringoli@mail.mcgill.ca.

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Purpose Statement

The McGill Office of Science Education (OSE) has been in collaboration with the Physics Department in order to:

> "… investigate how to enhance the teaching and learning of Physics in undergraduate lab courses through evidence-based, inquiry-guided strategies."

To this end, OSE has developed a new Physics TA training program to better help TAs and the undergrad students they support. This program focuses on explaining the basics of TA duties at McGill with some ways of applying inquiry-guided strategies concretely to those duties. To complement the in-person training sessions, which focus on inquiry-guided learning, this handbook has been written to be a living resource for Physics TAs on:

- McGill resources for graduate teaching assistants
    - Resource List
    - Appendix with OSE Resources

- Regular expectations of TA duties and basic principles
    - Grading
    - Laboratories
    - Tutorials/Office Hours

- Short explanations of inquiry-guided learning (IGL) principles and their applications
    - Using IGL effectively as a TA

Please use this resource to review the basics of each common TA role, revisit any of the concepts gone over during the training sessions, or to crosscheck your methods as you complete your TA duties. Additional resources from the training sessions (slides, scenarios, etc.) will also be made available with this handbook to review further if desired.

If you have any questions regarding the concepts or processes in this document, please contact the current MGAPS TA Officer: benjamin.dringoli@mail.mcgill.ca.

Resource List

- **Office of Science Education (OSE)**
    - https://www.mcgill.ca/ose/
    - See Appendix for Extended List of OSE resources for TAs

- **Association of Graduate Students Employed at McGill (AGSEM)**
    - McGill's Teaching Support Union: "The Association of Graduate Students Employed at McGill (AGSEM) is the oldest Teaching Assistant Union in the province of Quebec. As a labour union, AGSEM represents TAs and Invigilators at McGill. AGSEM has bargained with the McGill administration to produce TA and Invigilator Collective Agreements, which are legal documents that protect student workers."
    - https://www.agsem.ca/

- **Skillsets**
    - "Skillsets is a centrally-managed suite of Professional Development workshops for Graduate Students and Post-Doctoral Fellows. The suite is jointly hosted by Graduate and Postdoctoral Studies and Teaching and Learning Services."
    - https://www.mcgill.ca/skillsets/
    - Resource list for TAs: https://www.mcgill.ca/skillsets/files/skillsets/resources-for-tas-sept-2021.pdf

- **Career Planning Services (CaPS)**
    - "The McGill Career Planning Service assists students in their career development and search for permanent, part-time, and summer jobs, as well as internships, by providing workshops, individual advising, a comprehensive job posting service, and an extensive Career Resource Centre."
    - https://www.mcgill.ca/caps/

- **McGill Graduate Association of Physics Students (MGAPS)**
    - "The McGill Graduate Association of Physicists is a student run Graduate student organization in physics. We assist with academic, teaching, social, and other facets of grad life in the Physics Dept. Don't be afraid to look on our website for an officer to contact with any questions you have!"
    - https://mgaps.physics.mcgill.ca/

- **McGill Counselling and Mental Health Services**
    - "The Hub provides McGill students access to health and wellness services and programming. Whether you want to build your wellness community, access a clinician, learn a new skill, or relax in our space, the Student Wellness Hub is here for you!"
    - https://www.mcgill.ca/wellness-hub/

Grading

Grading is one of the most common TA tasks, especially in first year courses with large enrollments. It's important to meet with your teaching Prof early in the semester to communicate expectations around timelines, points awarded, learning goals, and office hours.

Regardless of the type of work you're marking (exams, quizzes, assignments), you will need a rubric to make sure you have a clear idea of the correct solution and the concepts which the students should be applying correctly. Using a **consistent and prepared** grading rubric will make your marking both fair to students and efficient for you, as you will have clear paths to feedback and won't have to go back and adjust marks after seeing the responses students submit.

Designing a good grading rubric:

- Spend enough time on it to make it useful
- Stick to your rubric once it's set
- Give the rubric to the students to let them know how you graded

A step-by-step procedure could be as follows:

- Write down the components of a correct answer (keywords, definitions, arithmetic, dimensional analysis, procedure, presentation)
- Use your solution to identify a list of traits based on the components you listed for a correct answer (e.g., a diagram, properly set up analysis, etc.)
- For each trait, assign a number of points and decide how to deduce points for specific types of errors
- Look at a few student copies to see if you covered all possible errors

Grading isn't all about points awarded, though. It's also a key time to provide students with support in what they did well or need to improve on. Your feedback as a TA is key, and it's worth thinking about how to guide your students to a better understanding through pointed comments. Taking a few minutes to brainstorm effective feedback can also save time since you can apply the same framework of comments to many submissions if it's well thought-out and complete.

Provide useful feedback:

- Write explicitly where marks are lost and the point total per question
- All feedback should define the actions a student can take to improve
- Make a list of common errors and communicate them to the class

Finally, sometimes you will be faced with challenging deadlines, workloads, or student submissions that make grading difficult. When this occurs, you'll have to consider what matters most when you are marking assignments. Is it:

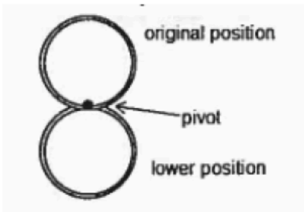
- Being a consistent grader?
- Giving useful feedback and giving the class the opportunity to adjust?
- Prioritizing computational correctness or conceptual understanding?
- Being punctual on submission times (for both you and the students)?

Remember to reach out to your fellow TAs or the Prof if you have serious concerns about your workload or the quality of student submissions. Grading and feedback skills are something that develops through experience and seeing the strategies of others. You may be able to access the rubrics of past TAs to help expedite your work or give you suggestions for your own feedback if assignments are reused each year, so ask around!

Example
In the following pages, there is a sample solution sheet and several student submissions for an exam question that you can use to practice forming a grading rubric or formulating useful feedback. Think of how you would divide points among the different parts of the questions or how to guide students on where they can improve.

Question

The figure below shows a circular hoop of radius R and mass M in a vertical position and attached to a frictionless horizontal pivot on its lower edge. If the hoop is now nudged (given a gentle push), it will swing down to the lower position shown.



a) Calculate the torque on the hoop when it is at the horizontal position (not shown in the diagram) - that is, when its center-of-mass is at the same height as the pivot point.

b) Calculate its angular velocity ω when it is in the lower position.

c) If the hoop were stopped in the lower position and then gently nudged, what would be the period of the resulting oscillation?

Solution

a) The torque τ produced by a force F applied at a distance r from a pivot is

$$\tau = rF \sin\theta$$

In this case, the force is gravity, which has magnitude $F = Mg$, and the position vector has size $r = R$. The torque is then

$$\tau = MgR$$

since the two vectors are perpendicular.

b) For this we use conservation of energy. At the top, the hoop doesn't move so it has no kinetic energy. It has potential energy $U_i = Mgh$, which is due to gravity. Putting the zero at the bottom gives $h = 2R$. At the bottom, the hoop doesn't have any potential energy and it has a kinetic energy $K_f = \frac{1}{2}I\omega^2$. Conervation of energy then gives

$$2MgR = \frac{1}{2}I\omega^2$$

The moment of inertia of a loop rotation around its center point is $I_{CM} = MR^2$, but it now rotates around another point so we have to calculate the new moment of inertia with

$$I = I_{CM} + MD^2 = MR^2 + MR^2 = 2MR^2$$

The angular frequency is then

$$\omega = \sqrt{\frac{4MgR}{I}} = \sqrt{\frac{4MgR}{2MR^2}} = \sqrt{\frac{2g}{R}}$$

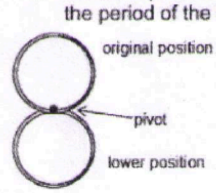
c) The formula to calculate the period is

$$T = 2\pi\sqrt{\frac{I}{MgR}} = 2\pi\sqrt{\frac{2MR^2}{MgR}} = 2\pi\sqrt{\frac{2R}{g}}$$

Student 1

3) [8 pts] The figure below shows a circular hoop of radius R and mass M in a vertical position and attached to a frictionless horizontal pivot on its lower edge. If the hoop is now nudged (given a gentle push), it will swing down to the lower position shown.

a. Calculate the torque on the hoop when it is at the horizontal position (not shown in the diagram) – that is, when its center-of-mass is at the same height as the pivot point.
b. Calculate its angular velocity ω when it is in the lower position.
c. If the hoop were stopped in the lower position and then gently nudged, what would be the period of the resulting oscillation?



a) Center of mass = 1R From the pivot

$\tau = rF\sin\phi$ F = Force of gravity = gM

$\boxed{\tau = RgM\cos 0° = RgM}$

b) $\omega^2 = \omega_0^2 + 2\alpha_2 \Delta\theta$ $\omega^2 = 0^2 + 2(9.81\ m/s^2)(\pi)$

$\boxed{\omega = 7.85\ rad/sec}$

c) The hoop acts as a physical pendulum so this equation is used: $T_{(period)} = 2\pi / \sqrt{\frac{mass \cdot g \cdot d(\text{distance from axis of rotation})}{I(\text{inertia})}}$

To be honest I have no idea how to calculate inertia for a loop :(

$\boxed{T = 2\pi / \sqrt{\frac{M \cdot 9.81\ m/s^2 \cdot R}{I}}}$ This is the best I got

Student 2

3) [8 pts] The figure below shows a circular hoop of radius R and mass M in a vertical position and attached to a frictionless horizontal pivot on its lower edge. If the hoop is now nudged (given a gentle push), it will swing down to the lower position shown.

a. Calculate the torque on the hoop when it is at the horizontal position (not shown in the diagram) – that is, when its center-of-mass is at the same height as the pivot point.
b. Calculate its angular velocity ω when it is in the lower position.
c. If the hoop were stopped in the lower position and then gently nudged, what would be the period of the resulting oscillation?

b) Parallel axis thm must be applied since the hoop does not rotate around its centre of mass.

a) $\vec{\tau} = \vec{r} \times \vec{F}$

$\vec{\tau} = rF\sin\theta$

$\vec{\tau} = RMg$

$I_{PA} = I_{CM} + MD^2$

$I = MR^2 + MR^2$

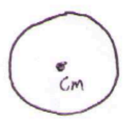
$I = 2MR^2$

$mgh = \frac{1}{2} I\omega^2$

$Mg(2R) = \frac{1}{2}(2MR^2)\,\omega^2$

$\omega^2 = \frac{2g}{R}$

$\omega = \sqrt{\frac{2g}{R}}$

c) 

Period of a physical pendulum : (Formula discussed in class)

$T = 2\pi\sqrt{\frac{I_{pivot}}{mgr}}$

$2\pi\sqrt{\frac{2MR^2}{MgR}}$

$T = 2\pi\sqrt{\frac{2R}{g}}$

- a) Torque in loop $\vec{\tau} = gMR$
- b) angular velocity at bottom $\omega = \sqrt{\frac{2g}{R}}$
- c) Period of hoop $T = 2\pi\sqrt{\frac{2R}{g}}$

Student 3

3) [8 pts] The figure below shows a circular hoop of radius R and mass M in a vertical position and attached to a frictionless horizontal pivot on its lower edge. If the hoop is now nudged (given a gentle push), it will swing down to the lower position shown.

a. Calculate the torque on the hoop when it is at the horizontal position (not shown in the diagram) – that is, when its center-of-mass is at the same height as the pivot point.
b. Calculate its angular velocity ω when it is in the lower position.
c. If the hoop were stopped in the lower position and then gently nudged, what would be the period of the resulting oscillation?

a. $\tau = rF\sin\theta = I\alpha$

$\tau = Mg$

b) $\frac{1}{2}I\omega^2 = mgh$ $I_{hoop} = MR^2$

$\frac{1}{2}MR^2\omega^2 = Mg\,2R$

$\frac{1}{2}R^2\omega^2 = g2R$

$\frac{1}{2}R\omega^2 = 2g$

$R\omega^2 = 4g$ $\omega = \sqrt{\frac{4g}{R}}$

$\omega^2 = \frac{4g}{R}$

c. $T = 2\pi\sqrt{\frac{L}{g}}$

$T = 2\pi\sqrt{\frac{R}{g}}$

Labs

Student laboratories, whether as part of a lecture course or as courses in their own right, are important opportunities for students to apply their knowledge and gain experimental skills through doing. **They support the development of experimental skills, which exist on a different axis from knowledge and theory of physics.** As their guide, and as someone who has been in their position before, it's your job to help them stay on the right track while also letting them learn experimental practices though trial and error.

Important points:

- Use your own experience as a student to understand their mindset
- Practice the experiments and think about pitfalls
- Think about what the main learning outcome of an experiment is
- Do not just give the answers to their questions
- Don't wait, be proactive if you see students struggling
- Get to know the lab technicians, they're the teaching lab experts

As in any other position, make sure to communicate objectives not only with your Prof, but also your fellow TAs who will be facilitating the lab with you. You will be handling questions and situations together, so being on the same page and making sure to be prepared are key for you and your student's success.

Labs have high potential for the application of inquiry-guided learning (IGL), since they are (usually) a physical playground for students to try ideas, get feedback, and build intuition. As such, we encourage lab TAs to read through the IGL application section in this handbook, which has an in-depth guide for asking students effective questions, answering student questions to advance understanding, and exposing students to an appropriate level of inquiry/uncertainty in their experimental plan.

Labs also have the widest range of possible interactions with students, so considering some challenging student interactions and having a plan is useful. Below are some commonly faced encounters with examples of how you can address the situation and have both parties complete what they need to do. Further ideas are available in the appendix (checklist on dealing with challenging situations).

A student has constant questions or interruptions:

- Politely ask if you can finish your explanation first.
- Point out that other students might also have questions.
- Ask the student to write the questions down for later, so the student can focus on distilling their explanation.

A student disagrees with everything:

- Reviewing the material before the lab can help you be prepared for any viewpoints the student presents.

- If you’re not sure about something, say you’ll think about it/look it up/ask the professor about it and that you’ll come back to it later.
- If the students complains about the organization or schedule, hear the student out but don’t give in.

A student enters class late or leaves early:

- Know the university’s, the professor’s, and your own rules in advance.
- Set boundaries and be consistent.

A student disrespects other’s right to express viewpoints.:

- Never call a student’s question or comment stupid/dumb/etc.
- Say something like “well, I’d like to hear [other student’s] thoughts on this.”

A student does not like their lab partner:

- Try to console and find a solution.
- Suggest they make clear agreements on who does what.
- Guide them in giving constructive feedback to each other, e.g., “when …, you do …, that makes me feel ... , I would like if you …” considering the situation, behaviour, impact, alternatives, etc.

These strategies can help keep things running smoothly during the lab session, but as with all challenging situations, serious or repeated disruptions should be brought to the Prof’s attention for them to address. We also suggest lab TAs to read the section on grading and feedback, as many of the points there are directly relevant to the marking and feedback given on lab reports.

Tutorials/Office Hours

Tutorials and office hours are your students' chance to get in-depth feedback and ask questions, as well as your opportunity to communicate objectives, give tips, and clarify concepts. Since they are closest to a lecture environment, they also provide you with a chance to develop your teaching skills.

Tutorials can be led in many formats, so communicating with your Prof and students on what will be most effective is key to do both at the beginning and throughout the semester. Some potential tutorial formats are:

- Solving problems on the board
- Lecturing on confusing topics
- Group problems and review
- Q&A session
- Practice coding or using software
- Quizzes or practice problems
- Any linear combination of the above!

Like labs, you're likely going to be answering many student questions in tutorials/office hours, so we suggest reading the IGL application section of this handbook, which goes in-depth into these topics and will give the most functional advice for leading sessions.

Tutorials in particular can be a great opportunity to practice teaching course content, as a good review for yourself and as practice giving presentations and speaking in front of groups. Many TAs find tutorials particularly effective in developing these, as well as organizational skills:

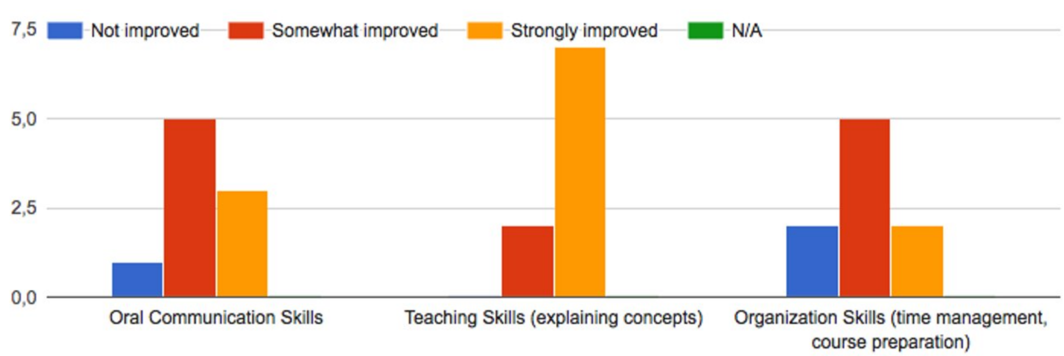


Figure 1: Self-reported skill gains in McGill physics TAs after leading tutorial sessions (2018)

They also allow for a greater degree of student contact, as they feel more interpersonal than the relationship through marking or in a lab session with clear goals. Focusing on how you provide support for students and allowing them some say in how you decide to run your sessions can lead to higher engagement, more utility, and fewer students coming back with questions later on.

Finally, engaging with students can also grow your understanding, so being open to their ideas and working with them to see concepts through is worth it:

> “Sometimes a student asks you a question that makes you learn a different way of thinking, and this is very valuable”
>
> “Helping a student make an important connection and learn something makes you feel like you’re really making a difference”

Promoting Inquiry-Guided Learning as a TA

Inquiry-guided learning (IGL) is an approach that places **student curiosity and exploration** at the center of the learning process. Instead of telling students what they need know and assuming they understand, IGL encourages students to get their hands dirty and develop their own understanding of course material through asking questions, problem-solving, and sharing ideas. Essentially, IGL is about students taking responsibility for their learning and becoming independent thinkers (Banchi & Bell, 2008; Buck et al., 2008; Weaver et al., 2008, Lee 2012).

<u>IGL characteristics</u>:

- Curiosity-driven
- Independent thinking
- Active student participation
- Models scientific research

The following sections include different ideas of how to start incorporating IGL into your TAing to support student learning in Physics. You certainly don't have to apply them all, but think of how certain approaches could be useful in helping your students (and yourself!) be successful and efficient.

Asking good questions

Asking questions is a simple way of incorporating IGL into your interactions with students because questions actively engage them in the learning process (rather than simply 'going through the motions' without understanding what they are learning or why). Questions also help you to gauge where students are at in their learning and what TA support they might need at that time.

When deciding what questions to ask, considering the following:

1. *Make student thinking explicit*: encourage students articulate their thinking process aloud, to share their ideas, and to reflect on what they understand.
2. *Build on student thinking*: help students develop their understanding further by challenging their thinking or offering new ideas for them to connect to what they already know. (Van Zee & Minstrell, 1997; Kawalkar & Vijapurkar, 2013)

One IGL method for creating and asking questions, known as the Kawalkar categories, is outlined below. These categories can help you create questions that make student thinking explicit (1-3) or questions that build on student thinking (3-6).

<u>The Kawalkar categories for asking questions:</u>

1. Check background knowledge: what do students already know
2. Ask for explanations: draw on students' knowledge
3. Ask for justifications: identify the limits of students' knowledge
4. Ask for a way to prove or find out: challenge student's knowledge
5. Involve the class: encourage students to share their viewpoints and consider other perspectives or ideas

Figure 2: The Kawalkar IGL method for asking questions

Answering student questions
Asking good questions is essential to helping students articulate their thinking and guiding their learning, but answering students' questions is also important. When answering questions, three approaches can be used: corrective, directive, and facilitative (Chin & Osborne, 2008; Orsmond et al. 2013; Herranen & Aksela, 2019).

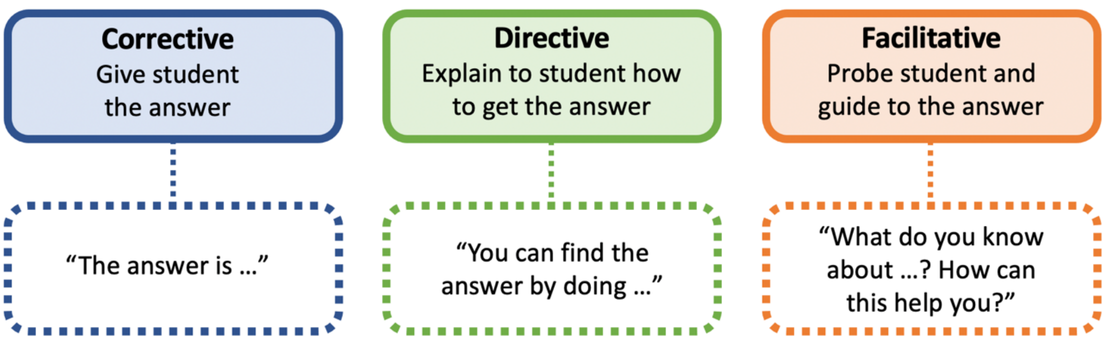


Figure 5: Three approaches to answering student questions

<u>The facilitative approach is most suited to IGL because it</u>:
- Identifies where students are struggling
- Helps TAs better target what support to give students
- Guides students to finding their own answer

While the facilitative approach promotes deeper learning and encourages students to be self-reliant, it might not be feasible or necessary to use this approach for answering all student questions. You will most likely use a combination of the three approaches when answering student questions.

Questions are at the center of IGL. For this reason, it is important to create an **inclusive space** where students feel comfortable asking questions. Remind students that:
- Asking questions is essential to learning
- All questions are valid (i.e., there are no silly questions)
- You are there to help them learn and they can rely on you for support

Providing effective feedback
In teaching, and in IGL specifically, feedback is critical for learning because it helps students know where they are at in understanding the course material and guides their future learning decisions (what should they keep doing, what needs improvement, what steps should they take to improve, etc.).

When giving students feedback, whether written or in person, comments should aim to help students troubleshoot their own learning performance and take action to improve:

Engage students in the feedback process. Ensure that students:
- Understand the general purpose of feedback
- Understand your specific feedback
- Have the knowledge and tools to implement your feedback
- Are motivated to improve on their next assignment

(Nicole & Macfarlane-Dick, 2004; Butler et al., 2013; Orsmond et al., 2013)

The SMART method is one way to approach giving students effective feedback:

Aim to provide SMART feedback:

Specific – What exactly should be improved? What exactly did students do well on?

Measurable – What needs more work? What needs minor changes?

Achievable – Do students have the knowledge or tools to implement your feedback?

Relevant – Is your feedback addressing skills relevant to the task or assignment?

Timely – Did you provide feedback in time for students to implement it?

When providing feedback, don't forget to address both what students did well and areas for improvement in students' work. Addressing what students did well informs them on what to keep doing, which can increase their motivation to implement feedback in the future (Winstone et al., 2017). Addressing what still needs work provides students with concrete areas for improvement. Aim for a **balance** between positive elements and areas for improvement in a student's work.

A note on grading and IGL
Grading students on their application of specific IGL goals can be difficult, as the application of IGL principles should be specific to the content and background knowledge level of the students. As such, there is no step-by-step guide for **evaluating** the application of IGL in this handbook.

You can take into account the IGL steps expected of students (coming up with their own solution procedure, trying multiple experiments, etc.) if it makes sense to do so, and assign points accordingly, but this may not be necessary for simple assignments that only require computation by a set method. This is another reason why confirming learning goals with the Prof early on is recommended, as you will know what types of inquiry are expected of students and how you can fold that into your awarding of points to better promote exploratory learning when it's appropriate.

Physics Community

The department and other offices at McGill have many resources for TAs, whether it be for teaching skills, help defining expectations, or using digital teaching resources. See the resources pages for some useful websites or contact the MGAPS TA Officer via their email listed on the MGAPS website. They are there as an experienced TA to answer any questions you have (no matter how basic) and point you in the right direction.

Most department grad students are employed as TAs (see below), and as such are also a great resource for comparing strategies, discussing new ideas, and providing support.

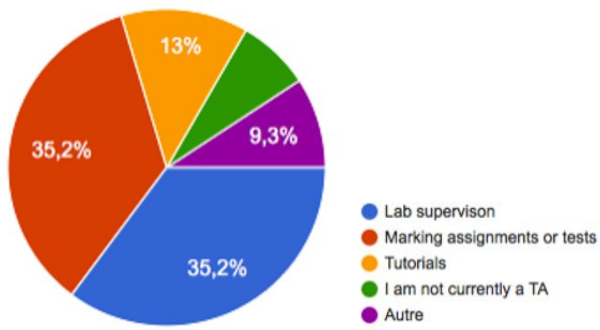


Figure 1: Breakdown of Physics department TA duties.

Remember to also discuss your TA obligations with your supervisor and senior research group members, as they likely have gone through this process many times. Keep an eye out for department emails regarding the TA signup form and any requirements (banking, McGill central database) that need to be completed for you to get your position or have your pay disbursed properly.

Most importantly, **make sure to set expectations early with your teaching Prof using the TA workload form.** This is typically required to be submitted within a few weeks of your TA appointment and helps you estimate the content and timelines of your duties. Try to keep a rapport with your teaching Prof so you can tell them of major pitfalls, suggest changes to better serve the students, or communicate your needs as they change throughout the semester. If you ever want help with this, the MGAPS TA Officer or VP Academic is a great place to start.

Your health during this process is of utmost importance, so know there is a network here to help you get the support you need, just reach out in any way you can!

Closing Statement

We hope that this guide is a useful resource in completing your teaching assistant duties and developing your skills as a teacher, facilitator, and all the other facets of being a graduate student. As you complete more TA positions and gain experience, you will learn which strategies presented here are useful for you, and maybe develop some of your own! We hope you will join in on the in-person training sessions to discuss what works and what hasn't for the benefit of the whole department.

Remember to stay organized, keep your priorities (including your health) in check, and reach out to any of the support networks you need, we're here for you.

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Appendix: OSE Resources

Three checklists with strategies to support teaching and learning:

- Creating a Positive Learning Environment
- Effective Teaching
- Addressing Challenging Situations

Creating a Positive Learning Environment

Foster a positive attitude

- Show interest in your subject and enthusiasm for learning.
- Be open-minded: be aware of the possibility that a problem behaviour exhibited in class may be due to a reason other than laziness or lack of preparation.
- Give students the benefit of the doubt: start from a place of assuming that all students are there to learn.

Create a welcoming and inclusive space

- Treat students as individuals whose identities are complex and unique.
- Allow students to volunteer information about their experiences or backgrounds, but don't ask students to represent their entire race/culture/gender.
- Learn student names with the correct pronunciation (this shows respect).
- Introduce yourself and have students introduce themselves on the first day. Consider making it fun and using an icebreaker activity.
- Encourage full participation while being aware of differences that may influence students' responses. For example, during in-person discussions, ask questions that draw out quieter students or that challenge dominant students in small groups.
- Many students benefit from both seeing and hearing language (e.g., through the use of the blackboard/projector), and from hearing key ideas stated in different ways. Consider using video links or diagrams in your written communication with students.
- If the room allows, have students gather periodically around a central table for discussions. Bringing people together may enhance engagement and a sense of group cohesion.
- Provide positive and constructive feedback to students as they complete exercises and assignments. Noticing good results or improved technique helps keep students motivated. Likewise, reach out to those who are not doing so well and express your willingness to help them.
- Avoid using judgmental statements. Instead of "*You made a syntax error in this section of code,*" use neutral language like, *"There is a syntax error in this section of code."*
- Offer students the chance to identify when something has gone wrong and suggest reasons and solutions.
- Set clear expectations about when you will be available to students. This helps students know exactly when and how they can reach you, and allows you to create work boundaries. For example, you may explain that you answer emails within 24 hours, between 9 am and 5 pm.

Communicate the roles expected of the TA and the students in the class

- Remind students that TAs have a teaching role — you are there to facilitate their learning and this requires you to act differently than you would if you were a peer.
- Let them know this will mean pushing them to take responsibility for their own learning, you may answer a question with a question to get them to think about an idea, or you may tell them, *"Try and see what happens…"* to foster learning.
- Don't be vague or unclear about what you are doing; provide explanations and let them know the reasoning behind your actions, and be willing to repeat instructions and ask students if they have specific questions.
- Create group guidelines, and review these with students as the semester progresses. You can create these yourself and invite students to add their own ideas (e.g., respect all students' right to speak and share their thoughts).

Effective Teaching

Give clear instructions

- Be consistent and prompt students about starting and finishing the class on time.
- Leave key points and instructions in an accessible area (whiteboard, discussion forum homepage, etc.) for students to refer to during class time.
- Do not hesitate to explain things more than once or answer questions that you may consider simple (remember, students are novices in the discipline).
- Periodically announce what sections students should be working on at a given time, and provide support to individuals or groups (without rushing them) who are lagging behind.

Ask and answer questions

- Avoid asking a question and answering it yourself. This might set a pattern where students wait for you to answer instead of responding.
- Give students enough time to think. A good guideline is to wait at least 3-5 seconds for most questions, or 10-30 seconds for analytical or application questions.
- When online, allow at least a few students to answer a question before adding your input.
- During discussions, encourage students to answer each other's questions. Instead of answering yourself, focus on providing meaningful contributions such as pointing out themes, highlighting important concepts, correcting inaccurate ideas/posts, and summarizing the conversations.
- Correct wrong answers to avoid the propagation of incorrect ideas, but not too bluntly so as to discourage a student from answering again. Soften the impact of a correction by depersonalizing your feedback so that you are correcting the idea, not criticizing the individual who said it.
- If you don't know or are unsure of an answer to a student's question, say you will find out for them. Don't bluff.
- When you are asked the same question multiple times, or multiple individuals have the same problem, it is likely that other students will have the same question or problem. Gain everyone's attention and use this moment to provide targeted "just in time" instruction for everyone.
- Encourage students to share their perspectives. It is often helpful to initiate communication with a positive or neutral statement, followed by guided questions or reassuring statements. Some students may need an invitation to voice their questions. Here is an example prompt: "*You both seem to be well-organized. Do you have any questions about the tutorial exercises today?"*

Monitor students

- Move around the room to make yourself accessible to students, focusing equal time on individuals or groups that ask and those that don't ask for help.
- When online, participate in discussion threads to demonstrate TA presence, but avoid over- or under-involvement, which can lead to less student participation on the discussion board.
- Don't assume that since a student is quiet, they know what they are doing.
- It is always useful to approach a student or a group and prompt them with, *"Tell me what you are doing"* or *"How's it going?"* to find out if they are on the right track, if they have questions, or if they have something they would like to double check with you.

Help students deal with difficulties and mistakes during class time

- Ask questions to help students understand how to deal with mistakes. A short sequence of questions can model systematic critical thinking, such as, *"What's the purpose of the exercise? Does the mistake matter for this particular exercise? Why would the mistake* *matter in general?"* Don't ask too many questions if the student must rush to recover from an error without falling behind.

- When students have trouble with an exercise, you may ask process related questions such as, *"How did you begin? Where did you first have trouble?"*
- Help students avoid errors that may cost lots of time. You may need to repeat an announcement or check on students' progress more frequently if everyone must get to a certain stage in an exercise on a given day.
- Be prepared; look through assignments/course material ahead of time. Identifying potential places where students might have difficulty can help you to better anticipate the types of questions may ask you during class.
- If students require one-on-one attention, such as reviewing an assignment), set up a schedule for individual meetings to take place (e.g., during your office hours). Ensure that individual feedback sessions are available to all students in your class.
- Encourage students to work together to problem solve mistakes. Group students with similar problems and concerns, and provide groups with help as necessary.

Addressing Challenging Situations

When the group is silent and unresponsive

- Check for understanding by asking, *"Can anyone summarize the main goal of today's exercise?"* or *"Can anyone remind us of the connection between what you learned in class and today's tutorial questions?"*
- Asking students to respond to a question in writing before responding aloud gives them time to form their own thoughts and they may be more likely to share aloud.
- Think, Pair, Share: when you've asked a question and are not getting any responses, ask students to turn to a partner to answer the question. They may be more willing to volunteer when they have checked their answers with a peer. You can also listen in to their responses to see if most groups understand the material.
- Check in with the class. For example, you may ask, *"Does this question make sense?"* Students may not always be forthcoming in saying they don't understand, but they will appreciate that you are acknowledging a change in the group dynamic.

When one or two students dominate the discussion

- Move around the room; sometimes just moving closer or farther to certain students conveys the message that you are interested in participation from everyone.
- Use phrases such as, *"Let's hear from someone who hasn't spoken yet"* or "*Let's hear from one of the other students/groups."*

When the discussion turns into an argument or disagreement

- You can use phrases such as, *"Let's slow down a moment"* or *"Let's move on."*
- Try to depersonalize positions of disagreement that have emerged and bring other students into the conversation: *"We've heard perspectives A and B, how else might one think about this question?"*
- Help students find common ground: *"You both care deeply about…, but you have strongly divergent ideas about how to get there."* Consider asking the group, *"What do these perspectives have in common? How do they differ?"*

When the discussion goes off track

- Give criteria for responses (e.g., ask for just one response per person).
- Write the student's idea down and place it in the "parking lot" – a designated space for keeping track of all general ideas. At the end of the session, ensure that you make time to address each of the items and ask the group if questions still remain.
- Acknowledge that there is limited time during the class, but that you would be happy to discuss their question or idea with them outside of class (e.g., via email).

When one student is not on-task

- Encourage the student to follow the instructions on the board and ask if there is anything in particular holding them back.
- If you have established guidelines, remind students that the action (e.g., showing disrespect to classmates) is not appropriate in the context of the guidelines the group has agreed to.
- Try not to get rattled—take a deep breath, allow some silence, and then respond. This gives you some time to plan a response that models for the students how to handle a difficult situation.

When you don’t know the answer to a question.

- It’s okay to admit that you don’t know. You might say, *“I’m not sure about the answer to that. I’ll have to get back to you”* or *“That’s an interesting question. What do you think?”*
- If you are unsure, tell the individual or the group that you need some time to reflect on this situation before responding directly.

When you make a mistake

- If you’ve made a mistake with, for example, the content you provided, acknowledge the mistake. All TAs will make a mistake at some point, and that is okay; treating yourself with compassion also models for students that they can safely take risks and make mistakes.
- Consider using your mistake as a learning opportunity. For example, you may ask students to reflect on what would have happened if the mistake hadn’t been noticed.

When some students aren’t comfortable participating or are unable to participate in an activity

- Recognize that participation looks different for everyone. It’s possible that a student is engaging in a different but equally valuable way.
- Consider incorporating multiple teaching strategies into an activity in order to engage as many participants as possible.
- If you initiate an activity and a student notifies you that they cannot participate, ask if there is an alternative with which they would be comfortable. For example, if you design an activity that requires students to move around a lot, but have a student with impaired mobility, consider how you could restructure the activity so that everyone can learn that day.
- If you notice that a student is consistently disengaged, privately ask them if there’s something you can do that would better facilitate their participation.

When you don’t know how to handle a situation.

- Resist the urge to label the student or blame them for the problem. Seek out help and rely on the available resources to problem solve. Remember to respect confidentiality.
- Speak to your course coordinator and describe the situation in detail, with specific examples.
- Speak to your professor and describe the situation in detail, with specific examples.

These checklists are a work-in-progress and are based on text and ideas in the following resources:

- **Strategies for Effective Teaching in the Laboratory Class**
  Adapted from Allen, O'Connell, Percha, Erickson, Nord, Harper, Bialek & Nam (2009)
  http://www.crlt.umich.edu/gsis/p7_6

- **Collected Wisdom: Strategies and Resources from TAs to TAs**
  https://www.cmu.edu/teaching/resources/PublicationsArchives/CollectedWisdom/collectwisdom-teachingstrategies.pdf

- **Inclusive Learning Environment Strategies**
  https://www.celt.iastate.edu/teaching/creating-an-inclusive-classroom/creating-an-inclusive-learning-environment/

- **How to Make Your Teaching More Inclusive**
  https://www.chronicle.com/interactives/20190719_inclusive_teaching

- **Dealing with Challenging Situations in the Classroom**
  https://tlss.uottawa.ca/site/images/1-TLSS/TA/documents/TAv2n1.pdf

- **Mastering online discussion board facilitation, TeacherStream, L. L. C. (2009).**
  https://teaching.temple.edu/sites/tlc/files/resource/pdf/MasteringOnlineDiscussionBoardFacilitation.pdf

- **Preparing Guidance for Online Teaching Assistants.**
  https://www.pfw.edu/dotAsset/95590dbc-7703-489e-9933-503cf045ebe1.pdf

- **Basics of Office Hours**
  https://www.scribd.com/document/365772471/Handout-Basics-of-Office-Hours-2014-AA

- **Using the Universal Design for Learning Approach in Science Laboratories to Minimize Student Stress**
  https://pubs.acs.org/doi/abs/10.1021/acs.jchemed.6b00108

- **Transforming Laboratory Teaching Assistants into Teaching Leaders**
  https://www.tandfonline.com/doi/full/10.1080/07294360.2018.1484707