CMCL 507 Portfolio

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1 Introduction

Peer mentoring hasn't always been a part of my plan. Though I did have a passion for education when I entered this class, I fell into registering for it instead of actively seeking it out. However, once I jumped in, I quickly realized that not focusing on this class would both be detrimental to myself and to the students I was mentoring. Now that I'm on the other side, I'm proud of the work that I've completed and I believe that I've found a new passion in education.

Working with Aran McDowell, my peer mentoring partner, I believe we made a difference in our host class. We were helping in PHYS 457 (Electromagnetic Theory III), which in the past has been considered a very math-heavy physics course. Dr. Jason Donev, our host instructor, has tried to change that over the past two years. Aran and I were both a part of the first year, last year, in which he attempted to integrate worksheets into the classroom. It wasn't always smooth sailing. Regardless, the worksheets were helpful, and many of the students saw that. Coming into his classroom now as peer mentor, we had as a goal to iron out some of those bumps in the road by facilitating groups tackling a worksheet. I believe that we've helped to accomplish that and more as a part of his class, and that I've grown throughout my participation in the program.

Over the semester, I've accumulated some great experience working with learning resources in my host class, but I've also developed many of my own resources in the peer mentoring classroom. I've found that merging what we're learning directly into the classroom is quite intuitive, as many of the situations being discussed in CMCL 507 arise in my host class. In this portfolio, I present a curated collection of what I've accomplished, what I've learnt, and what I believe about peer mentoring in an active classroom. I have included my reading summaries and critical reflections, which paint a picture of my state of mind throughout the semester. I've also included resources from my time in my host class, which illustrate the material to which I was applying the theoretical concepts, and an outline of the lecture that I facilitated for CMCL 507. By the end of this portfolio, I hope that you will have a thorough understanding of my thoughts as a peer mentor, as well as what I have accomplished during my time in CMCL 507.

2 Semester Plan

At the beginning of the semester, I laid out a short plan for what I wished to accomplish during the semester. This represents an example of my concerns as we began this class, and gives some context for the more reflection based content which follows. My views at this point were much less focused on helping students learn and more focused on being in the classroom and answering questions.

2.1 Plan

This semester, there are several skills that I would like to practice and improve. Firstly, I would like to practice how to manage some of the subtleties of contentious relationships in a professional setting. Since my host class is a core component to my degree, I know many people who are enrolled in a personal capacity. Most of them are friends, but there have also been moments of tension with some of them in the past, as can be expected. Though I pride myself on always being professional and conscientious, I would like to practice avoiding an unconscious bias in my interactions with everyone in the classroom, especially in terms of time allocated to each student when walking around the classroom and facilitating group discussions.

Second, I would like to practice my ability to quickly grasp the essentials of a topic to help guide a discussion. By walking around the class to facilitate student discussions, I have found that various groups will be stuck on different parts of a problem which may or may not be related. Sometimes my own knowledge of the material is enough to understand the situation quickly, but there are also times in which I struggle to understand how they are perceiving a certain question. I would like to learn strategies such that, without knowing the material inside and out, I can prompt them with questions to efficiently gain an understanding of their interpretation of a problem and guide them to the right answer.

Finally, I would like to improve my speaking skills, specifically in the form of creating instructional videos. As a part of my responsibilities, my host instructor has given us practice tests and solutions which he would like us to create solutions videos on. I have previous experience speaking in front of crowds and editing videos, but I have little experience with creating an effective tutorial video. Since videos such as this may be a good way to communicate with potential students in the future, I would like to gain experience with it while I have guidance on the content.

3 Mentoring Philosophy

Over this semester, I have come to several conclusions about peer mentoring and learning. I have summarized my opinions into a mentoring philsophy, which draws on the authors we studied this semester, below. This is constrasted with my semester plan above, as my mindset has changed immensely over the past four months.

3.1 Philsophy

In many classrooms, the primary source of information is assumed to be the professor at the front of the room. Paulo Friere and bell hooks have both informed my philosophy by reminding me that this is only an assumption and that there are other places from which students can learn. In a well-designed classroom, students are able to draw from all of the resources available to them, not just the professor. This includes other students, clicker questions, lecture

notes, worksheets, and whatever anything else in the room (perhaps minus their phones). Although students are fully capable of using these resources by themselves, peer mentors have the ability to help guide learning towards what might be most effective. The goal of peer mentoring, I have concluded, is to help students navigate the process of learning by taking a supporting and guiding role.

Lev Vygotsky has provided me with insightful context for peer mentoring, particularly when students are not yet able to complete a task. Vygotsky claims that, using scaffolding and other aids, the abilities of a student are expanded. His Zone of Proximal Development (ZPD) therefore informs how I select the best tool when helping a student, since my goal is not to solve the problem for them, but enable them to complete it using an aid. For example, one of the resources I have most commonly used is the students themselves. In a well-designed classroom, we can use discussion to prompt growth in students. Especially when completing a worksheet or answering a clicker question, students first come up with ideas on their own. Within any group, there's usually at least one concern, and it may or may not be shared by all members. Prompting and guiding discussion will, more often than not, enable everyone to reach a reasoned and correct solution. The fact that tapping into the wealth of knowledge within a group effectively expands the abilities of its members affirms to me that peer mentors can help students learn by directing them towards the appropriate tool for the occasion.

However, I feel that being too involved in a student's learning can backfire. Sometimes, students simply need time to process and internalize a concept. Vygotsky's theories speak about how a student can be enabled to do more, but don't directly address the timeline needed. Students may already have the ability to solve a problem but, as Peter Jarvis claims, humans learn in complex ways and often at different rates. Even if two students share the same resources to learn the same thing, I have observed that their process of learning will be individual. When mentoring a student, playing a supporting role in someone's learning experience also means that we need to recognize where they are in their learning cycle and when they need space. Students are smart and not helpless, but if we don't give them enough space while mentoring, we can force them to learn in ways that don't work for them. I don't believe this means we should take a hands off approach, but if returning to a students five minutes later means that they can formulate a targeted and well thought-out question, this time seems just as valuable to me as time spent in discussion with their peers.

Overall, being a supporting character in someone's learning to me means enabling them to do more, while being conscious of their current state. It requires a balance that I strive for, but have not yet mastered. As I continue to mentor students in other positions, I hope that I will be able to help them learn with each other, with other resources, and with a conscientious but helpful hand.

4 Reading Summaries

The reading summaries that follow contain summaries as well as brief applications of the author's thoughts to my mentoring. These readings are important to my growth throughout this class, as they informed many of the techniques and solutions that I used to solve problems in class. They also allowed me to recognize problems that I hadn't yet recognized in class. These paint a picture of how I began to change how I thought about what was happening in my host class.

4.1 Classroom Activities for Active Learning

Classroom Activities for Active Learning is a short paper amalgamating techniques to enhance learning in a university setting. It specifically talks about techniques to engage higher cognitive levels by complementing regular lectures. Activities summarized were divided into four categories: questioning techniques, small groups, whole class involvement, and reading & writing exercises. All of the categories have been shown to be complement to lecturing such that they elicit higher cognitive level responses.

The first grouping concerns formulas for how to ask questions targeted towards higher level responses than regurgitation. Examples are provided for remembering questions (often start with 'What'), application questions (often start with 'How'), and evaluation questions (often ask for a solution and justification). It is suggested that questions build such that there is a steady progression, which will reinforce the different levels of learning. To combat only some students repeatedly answering questions, randomly calling on students can help if they are given enough time to formulate an answer.

Small group and whole class involvement are quire similar in their core goals: to encourage the involvement and critical thinking of all involved. All of the techniques consider the participation of everyone, either by splitting the class into groups so small that people can't hide in numbers, or by using light peer pressure to ensure that everyone contributes at least some. A common theme was using a hive mind to work through difficult concepts, and then integrating the important parts, as when we went through the critical reflection examples in class. All of the techniques are meant to complement lectures rather than replace them.

Finally, reading and writing exercises are a more tangible activity than simply discussing, and provide a concrete method to work through a text or idea. Reading from texts is a very thorough way to consider a work, and writing is a great way to synthesize ideas and concepts before or after class. Any of the techniques discussed can be useful and will vary slightly depending on how a professor implements it.

4.2 The Nature of Learning

The Nature of Learning a is a document which concerns many essentials for a modern classroom. The authors highlight the importance of social learning, or more precisely socio-constructivist. They claim that by structuring

a learning environment such that students are responsible not just for their own learning, but also the learning of others, learning efficiency is improved. Such environments are self-regulated, collaborative and sensitive to context.

One particular term which I liked was adaptive expertise, the ability to apply knowledge to new situations flexibly and creatively. This stood out to me as something that I have personally applied in the workplace, especially when attempting to bridge a gap between people who are not studied in the same areas as myself. Pursuing this, the authors provide broad approaches: guided, action and experiential learning. By being sensitive to these three types of learning, students are able to further their skills independently.

Motivation and emotion also play an important role in learning. Motivation is intuitively something which would affect the efficiency of learning, but the authors go further to provide specific descriptors of a motivated student. This is helpful if applying it in a classroom.

The authors also state 7 Principles of Learning. These reiterate many of the points talked about previously in a structured manner. Some highlights, which differ from above, include putting learners at the center of the learning environment, stretching all students by being sensitive to individual differences, assessment for learning which provides both the what and why of the learning material, and building connections to reinforce a concept to be used creatively.

Finally, lifelong learning is emphasized throughout. Either by instilling these techniques in students or by having students be explicitly aware of them, self-directed learning can occur at any point within one's life. All of the techniques presented are not be looked at as individual, but as pieces to a while which "should be present in a learning environment for it to be judged truly effective."

4.3 The Art of Collaborative Learning: Making the Most of Knowledgeable Peers

The Art of Collaborative Learning: Making the Most of Knowledgeable Peers talks about just that, collaborative learning. Specifically, it talks about what a collaboration is and its interrelation with socio-constructivism and autonomy. To begin, it talks about collaboration as a useful way to review work, be innovative, flexible and adaptable. By collaborating, it says, students synthesize ideas of multiple people rather than one. In society, we naturally form autonomous learning groups for things like reviews and large projects. This is part of the basis for socio-constructivism, and relates it to collaboration as they both assume that learning occurs and is reinforced by interactions. While no conclusive study on collaboration's effectiveness is provided in this essay, there is some emerging research suggesting that a collaborative environment produces better learning results than a competitive, individual environment.

Through my experience mentoring, I have noticed that learning in table groups is incredibly helpful for correcting misconceptions in intuitive understanding. Further, M. L. J. Abercrombie is cited as asserting that people learn judgment skills best in groups. She claims discussion eliminates unshared biases and presuppositions. In my host

class, it is important to be aware that discussion will not always lead to the correct answer and that we should be there to guide them if needed (although not provide the answer).

Instructors also hope to raise student's social maturity and independence through semi-autonomous collaborative learning. Many fields, such as physics, depend on cooperation to ensure excellence, and these skill are most efficiently developed in a situation where everyone is interdependent. The key to this in the classroom is partial autonomy, where the instructor does not maintain direct control over the outcome of the learning. Rather, they provide a goal and allow students to form new connections in the community of their class. The importance of collaborative learning then seems to shift from the content itself to becoming a part of a community of equally knowledgeable peers. This re-acculturation process is essential to establishing working relationships, where people enter willingly into a relationship of giving others authority to contribute to a discussion.

This is the type of relationship that we, as peer mentors and mentees, need to foster. Without the consent of students, I cannot effectively do my job, nor can they collaborate with others. Ensuring that myself and the students are interdependent, and they are not dependent on me, therefore seems extremely important going forward.

4.4 Lake Vygotsky on Education

Lake Vygotsky on Education outlines some of Vygotsky's influences, and provides many examples and scenarios to explain the merits of his theories. Much of the chapter centers around something called the Zone of Proximal Development (ZPD), which refers to the environment in which students are learning, how their learning affects their development, and many other elements.

The theory that development precedes learning was widely believed at the time of Vygotsky's tenure. Development preceding learning suggested that people have a biological intelligence, which limits the learning that they can do at any stage of life. Contrary to most of his peers at the time, and in accordance with what we believe today, Vygotsky believed that learning preceded development, and learning was influenced by cultural and social context. Vygotsky advocated for a much more relaxed environment than common, where students are allowed to explore interests in contexts that motivate them to learn new things, no matter their perceived complexity.

Another popular belief at the time, behaviouralism, maintained that learning and development occurs simultaneously in response to stimulus. Repeated drills and recitation was believed to strengthen the mind and abilities of the individual since they establish reflexes to stimulus. Vygotsky, however, diverged from this as well. He believed that learning was most effective when students followed up and were allowed to establish connections between material. He eventually latched onto Koffka's work, which was new and didn't dismiss the possibility that learning influenced development. Vygotsky built off of this later on.

Vygotsky's ZPD shifted the focus from standards-based benchmarks towards a more learner-centric model. It acknowledged that context influence learning, and that focusing on deficits is not constructive for future potential.

Anticipation of positives provides more motivation both to the student and to the teacher. Scaffolding was later acknowledged as helpful to the ZPD to help reduce student anxiety and avoid demotivation due to failure. Worksheets that we currently employ in class can act as scaffolds and I think it will be helpful going forward to remind students that they're not just an assessment, but they're there to reduce stress and anxiety for tackling the work that they'll need to complete.

Vygotsky believed that one of the best ways for children to learn was through play. Its fun environment provides the motivation, and in turn creates a great ZPD. Learning is done by experiencing and pretending, giving a more in depth experience than study. Demonstrations in class are sometimes hard in physics, but I believe they're important and I'd like to have more of them in class since I think most people become more engaged. Finally, an important part of a ZPD is a mentor. We can point things out that student might not have noticed on their own, and encourage critical thinking, reflection, generative thinking, and other essential skills.

4.5 Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model

The paper "Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model" by Jennifer Mangels et al. talks about the interplay in between beliefs, goals, and learning success. The authors of the paper seek to justify the difference in between students who believe intelligence is fixed (entity theorists), and students who believe intelligence is continuously developing (incremental theorists). They do this by looking at brain activity and patters at different locations on the brain, and contrasting the measured activity across different stimulus for the two types of theorists. These stimulus take the form of tests on general knowledge. Administered on a computer, students were asked to answer a question, and then were given two types of feedback. The first type was performance-relevant feedback, and the second was learning-relevant feedback. Students were then retested on the questions which they answered incorrectly several minutes after the first test.

Overall, entity theorists reacted more strongly to negative performance-feedback, and seemed to engage less with the learning-relevant feedback. Since they engaged less with the performance relative feedback, they subsequently did worse on the retest than the incremental theorists. Even though the entity theorists may have processed the learning-relevant feedback on some level, they may be disadvantaged because they didn't spend as much time on it as the incremental theorists, as suggested by some studies. For all learners then, but particularly entity theorists, it may be helpful to purposefully prolong the discussion on difficult questions or questions where there is a common misperception such that retention in all students is better should it return at a later date.

Incremental theorists displayed less activity when presented with negative feedback in a region of the brain which is associated with dissonance between expected and actual results. The authors go on to say that a positive approach toward difficulty or challenges may lessen the effect of receiving negative feedback, since the incremental

theorists did significantly better on the retest than entity theorists. In a classroom, the environment of students and the mood within a group is important to manage to make sure that students are taking this positive approach towards a challenge such that negative feedback can be taken in stride.

Overall, this study supports the view that there is a difference between entity and incremental theorists in how they perceive performance-relevant information and process learning-relevant information. It also supports the view that internalized learning theories and views can influence how one seeks out information and experiences. If possible, it would be good to emphasize this in lectures and try to convince students than an incremental theorist perspective might actually help their learning.

4.6 Pedagogy of the Oppressed

This excerpt from Freire's Pedagogy of the Oppressed tackles some of the challenges with the standard educational model that we've seen in previous readings, but in much less uncertain terms. Freire's perspective on the current educational model is centered around his belief that teachers become the oppressors and the students become the oppressed in a standard lecture. This chapter from Freire's book first characterizes the teacher student relationship as narrative. The teacher is the narrator, and the students are those who listen quietly. He calls this "banking", as the students are storing, or banking, this knowledge for the future. He criticizes the banking concept for its ability to oppress critical thinking, expression, and impose a uniform understanding on students. Students are not expected to think or construct ideas, this is left up to the teacher. Socially, students are not given credibility before passing through this time-tested trial, something which Freire claims to serve the interests of the oppressors. Teachers, therefore, are creating an ideal to which the rest of the population is forced to subscribe.

Freire goes on to talk about communication and its importance in this process. One sided communication, or the dissemination of information, seeks to prevent thinking. Communication between both sides, however, creates a situation where a student can critique anything, and a proper discourse can take place. Without this type of environment, life is objectified away into absolutes and is no longer considered past the original conclusion. A hierarchical and rigid approach to education will only contribute further to oppression, no matter the context. Liberating education, Freire states, is composed of acts of cognition instead of the transferring of information. This takes place through problem-posing education, where people develop the power to critically analyze their place in the world and the world itself. Banking education paradigms fail to recognize individual context and knowledge, whereas problem-posing uses their history and context as a starting point.

Given that this book was written in 1968, during the rise of feminism and civil rights movements, I think it's useful to consider the tense social context before applying its teachings to our mentoring in class. Overall, I agree with many of the points put forward. I think that a pure lecture can oppress critical thought in students. However, it's hard to structure everything in terms of problems when there is a time constraint. When working with students

in small groups, posing problems and working as a group leads to a deeper understanding of the material, and it's extremely useful for working through hard problems. However, students regularly ask for a lecture to gain insight to a concept. Applying the teachings of this book, I would be conscious of how I structure the presentation of this information, such that I do not stifle further discussion (e.g. asking questions and prompting discussion amongst peers).

4.7 Transformative learning: Theory to Practice

Jack Mezirow's chapter on *Transformative learning: Theory to Practice* reiterates many of the topics that we have seen already. Transformative learning is seen by Mezirow as the true goal of education. When he says transformative, however, he's not necessarily talking about transforming one's self but about one's frame of reference (or reference frame). Reference frames are implicit in our world, and many people fail to recognize their impact.

Reference frames are composed of all things that affect the perception of a situation or piece of learning, including habitual thinking (e.g. someone raised in a conservative political environment) and points of view (e.g. not liking a particular politician). Points of view are less durable than habitual thinking and we can attempt to emulate a point of view when desired. People transform their reference frames through critical reflection on the implicit assumptions made. Critical reflection can happen with nearly any provocation which challenges these assumptions. A valuable ability is to be able to autonomously provoke this reflection.

Autonomous learning is centered around learners seeking out the information they need to learn and reflect on their assumptions. They are able to engage with others to validate what they come up with others through discourse. This is something that needs to be built upon throughout life. When younger, skills such as using informal logic are needed before new ones can be scaffolded on top later in life. Educators are able to help with this by catering education towards individual differences, creating situations which promote critical thinking, and have the goal of analyzing assumptions that they may hold. Educators can help with this by explicitly making it their goal to help individuals become more autonomous thinkers by learning.

To implement this is a classroom scenario, I would try to focus on challenging a student's reference frame. There are various ways to approach this but, in the case of a one-on-one situation, I think that directly questioning their perspectives, meanings and opinions on the subject might be the most efficient way to accomplish this. In this way, I would be able to actively challenge their reference frame and hopefully force them to critically reflect. In more of a group scenario, I sometimes find it more effective to ask students to challenge each other in the same way. By asking two students to correct each other through discourse, they are exposed to views that have the potential to force them to challenge their reference frame as well.

4.8 Towards a Philosophy of Human Learning

Towards a philosophy of human learning by Peter Jarvis is a piece that talks about shifting the focus in education from imparting knowledge to learning to a learner-centric model. Jarvis starts with philosophy about one's self. He concludes that to be a person, you must do something. This doing something makes you who you are. Jarvis adds that we are both being and becoming or, in other words, we are learning in the moment and becoming a new learner.

Jarvis credits the Kolb Cycle as a simplistic model with good intentions. It inspired him to introduce his new philosophy which expands on the concept. Jarvis expands his model to take into account the effects of time, motivation, acquisition, experience, reflection, and evaluation. All of these aspects interact and contribute in complementary ways to a learner's experience and internalization of information. According to Jarvis, all of our experiences, context, influences and existence combine into a learner's knowledge throughout their life. A person never stops learning because they still exist in the world and they still have experiences, transforming them as they continue living and existing.

To apply this article in the classroom, it's important to remember that learning takes place in many different ways. It's different from person to person, and it's different from class to class. As peer mentors, we can help people to find their stride in learning, but we must be careful that we do not lead them astray from what will help them learn the best. If we are able to judge where they are on their learning path, we can then apply corresponding techniques. For example, if they are learning unconsciously, we can make sure that the topic is moving fast enough and with enough depth for them. On the other hand, if they are becoming aware of new information, they might need to slow down and consider it. Then, we could simply give them time, or we could step in and try to help them walk through it. Overall, it influences our actions by giving us more context to a learner's experience.

4.9 Teaching to Transgress

bell hooks' book excerpt talks about the engaged pedagogy. She takes her inspiration from Freire and Thich Nhat Hanh, who was a Vietnamese Buddist monk. Freire inspired the portion of her work which involves rejecting the current banking system. She takes from Thich Nhat Hanh that teachers are supposed to be healers. Not in the traditional sense, but in the sense that it emphasizes well-being through self-actualization (the process of fullfilling one's potential). Starting with the teacher themselves, hooks believes that they cannot actively promote the same thing in their students without subscribing to it themselves.

In an engaged classroom, hooks emphasizes the use of personal experience, links to the real world and vulnerability in creating a classroom where students are able to self-actualize on their own. While practicing freedom in the classroom, students are allowed to critically reflect on guidance from teachers, choose to accept it, and relate it back to their personal lives. hooks both demonstrates and justifies her views by using her own personal stories and

the testimony of others, intermixed with her more straightforward arguments, to effectively justify her points.

Relating hooks' lessons to our mentoring, we can apply this in several ways. The first is to be more vulnerable with the students. By recognizing that we are human, we can connect with them on a different level and try to help them engage in more honest, critical thinking about a concept and it's connection to the world. Of course, this may not always help in physics in terms of the concepts. What we're trying to teach though is not necessarily the concepts themselves, but the skills to solve the problems independently. In this train of thought, I think it would be helpful if we let the students know that we're human, let them know where we've made mistakes and try to work through correcting them with them.

4.10 Nurturing Soul in Adult Learning

John M. Dirkx's chapter talks about the importance of mythos and soul in learning. Logos (logical arguments), though an incredibly useful tool for level-headed analysis, can sometimes limit our reference frames by disregarding our thoughts, feelings, and how we react to a situations. Dirkx asserts that we learn from an interaction between ourselves and an other using our soul, where the other can be anything. Learning through soul instead of through logical reflection can foster knowledge through more abstract means, such as symbolism, imagery and contemplation. In an abstract sense, Dirkx talks about how learning through and nurturing the soul can evoke a deeper change in the learner, and a transformation that is not necessarily covered by other authors that we have read who focus on the logical aspect of learning.

Learning through soul requires a connection between two people on an emotional level. In a group situation, someone in the group becomes the focal point of a learner's experience and can shape or embody the meaning that a participant is currently finding within their inner or outer world. Within his examples, he focuses on how people's behaviour within a specific context can reveal information about themselves to others. By finding problems in their environment, Dirkx says that they are finding the meaning they want to in others. They are projecting what they may be struggling with onto other participants, and the other participants can in turn point this out. Problematic aspects in the view of the participant can be returned by others in a constructive way, to reveal insight for the participant. Overall, Dirkx aims to bring attention to the role that someone's imagination, fantasy and its interplay with the world help with learning.

In our roles as mentors, we can apply some of what Dirkx gives as examples directly. If students are interacting with their peers in a group situation, we can try to make them see the value in the role that other people are playing and how they might be projecting their views onto others. In a physics classroom, it is sometimes hard to imagine how one can learn with soul given that we don't often have emotionally engaging discussions, but I still think people are emotionally invested in doing well. In the smaller actions that people take, the subtle way with with they interact with others while collaborating, can still reveal insights on that particular person. I think that the most

difficult aspect of this, however, is to turn around and make our observations meaningful for the learner.

For this final reading, we were also asked in class to create collages based on words we were provided. My word involved being happy regardless of context, and below is the collage that I created. I felt it should be included as it shows how an individual can represent their perception of a topic in a way that is meaningful to them based on their experience.

5 Critical Reflection

Critical reflections were one of my favourite parts of the CMCL 507 course. They not only allowed me to apply what I had learnt in class over the past couple of weeks, but also vent about things that had gone wrong and reflect on how to fix them. They represent an important part of the process that I went through in developing my own mentoring philosophy and style.

5.1 Critical Reflection 1

So far, most of my peer helping in classes follow a formula. First, a few minutes of lecture, then some clicker questions, and finally a worksheet. During both the worksheets and clicker questions, Aran and I walk around the class, check up on students, see where they're at, and make sure that everyone is understanding the concepts. Dr. Donev (our host instructor) uses many active learning techniques in his lectures, and they lead to situations which are sometimes challenging and interesting.

After our CMCL readings, I'm now finding that I can easily draw parallels in between what's happening in lecture and the theory that we're learning about in CMCL. For example, our clicker questions are cited by Classroom Activities for Active Learning as a method to elicit more interaction during class. Dr. Donev appears to be using this to gain an understanding of the knowledge of the class and suss out any potential misconceptions, assess individual differences and stimulate discussion. It's apparent that he looks for misconceptions using these questions through his interactions with us.

Today in class, he asked a clicker question on a concept which he privately told us that he was sure nearly everyone would answer correctly. To his surprise, however, 30 students voted for a wrong answer and only 8 students voted for the right one. None of the other answers were chosen by anyone. This demonstrated a clear and widespread misconception in the class, and so he modified his plan and asked us to go interact with each table group to help clear up the confusion. In my opinion, he specifically sends us around at points like this to stimulate discussion and provide immediate assessment for all participants. Luckily for me, in this case I understood the main misconception as I fell for the same trap at first before realizing my error. I attempted to help tables through my thinking process. I didn't quite realize what I was doing at the time (I thought I was just increasing the difficulty of my question in a natural progression) but, in retrospect, I believe I was applying some questioning techniques from Classroom Activities. After visiting a couple of tables, I found that the most effective way for me to guide students to correct their intuition was to begin with remembering questions ("Do you remember your right hand rules?"), move onto application questions ("How would you apply it here?...Given this context, is that application valid?"), and finish with an evaluation question hinting at their error ("Given this new perspective, what would be the best and most intuitive electromagnetic laws that we can apply to solve this problem, and are we able to eliminate any using context?"). This felt like such a natural progression that I'm convinced these techniques are effective, and I'd

like to keep exploring them going forwards (although I'm sure it will take more consideration to properly structure the questions if I don't understand the problem as well as I did in this particular instance).

On a related tangent, I reached a milestone with one of the students during this period as well. This student is particularly proud and has been quite cold when Aran or myself have tried to interact with them so far (although they are much more comfortable with Dr. Donev). Today, I had a slightly different approach which seems to have had a better result. Since the misconception today was widespread, I first addressed the whole group at the table and asked a tangential, guiding question. After giving them a second to think, I chose this person to answer the question to the group, rather than checking with everyone more one on one. They seemed particularly enthusiastic to answer the question, which they had a correct answer to, and the rest of the group was able to immediately use this to fix their mistake. Now, I'm sure there are many factors which affected their enthusiasm, but since this is the most positive interaction I've had with them so far, I wanted to quickly reflect and speculate as to what may be important factors in interacting with them going forwards.

Looking at The 7 Principles of Learning and what was different between this interaction and other interactions we've had, I think there may be some principles which stand out. By asking a general question, I was trying to pay attention to the social environment such that I didn't cause any awkwardness, as has happened in the past one-on-one. I think, as a result, there was an overall lighter atmosphere with everyone at the table compared to checking up with people in smaller sets. This might mean that both having a larger, more social group and the emotional context affect their learning more than other factors. As a peer helper, I don't want to introduce any negative emotions into his learning environment, especially ones which cause them to be dismissive of help, so this will be important for me to keep in mind going forwards. I don't particularly like using only a single data point for my conclusions, so I want to try speaking to the group as a whole again soon in the future. I'd like to compare results and see if a larger group setting is something that would be beneficial for them if used more consistently.

5.2 Critical Reflection 2

After exploring more readings and classes, I'm rediscovering the extent to which my host class has placed a focus on collaboration. Our worksheets in particular seem to have been thought out in a way that will contribute to a positive Zone of Proximal Development (ZPD). In relation to a ZPD, the sheets use guiding questions to create a scaffold to get to a complex conclusion. In this way, students are lead through concepts in a low-stress environment where answers are marked very forgivingly and based off of answers given in class. Mistakes are not punished here as they would be on an assignment, since students are given the chance to correct any mistakes before handing them in.

I think that, when students aren't able to complete a worksheet without assistance, most don't seem to be as demotivated as they would be if they couldn't complete an assignment. Beyond not weighted heavily in terms of

marks, perhaps this is because the worksheets don't carry the same expectation of already having the knowledge that assignments do. Even if an assignments are structured in the same incremental way, there's an implication that you should know this material since you're being tested on it. Going forward, I think it will be important to remind students that the goal of the worksheets is not to test them, but to help them through a topic before they have to do it by themselves. Framed in this new perspective, I hope to ensure that their ZPD remains as low-anxiety as possible.

On the topic of in class activities, these past two weeks have presented some new challenges. Recently I've been struggling to find a natural relationship with some of the more challenging small groups. I'd like to consider two groups with unique challenges in this reflection. The first is a group who sits in the back corner and is consistently off-topic. This feels like a staple of any class, and it's not that they don't do any work, but they usually reach an answer for group activities very quickly and without discussion, usually through the assertion of one answer and the passive acceptance of others. For the rest of the discussion time, they're usually off topic and I often find them to have the wrong answer.

In the context of our readings, I think Kenneth Bruffee's article on The Art of Collaborative Learning sweeps situations like these under the rug. He does mention that a "willingness to take on and exercise authority" is essential to successful autonomous collaboration, but he does not offer any solutions for if it's not present. In a non-ideal case like this, were the students are not willingly pursuing discussion and collaboration, a semi-autonomous model to re-acculturate has not been effective in my experience. Collaboration is sparse without a small amount of oversight, which in turn undermines the semi-autonomous nature of the group. Oversight may be a short term solution to the problem but, like Bruffee's article asserts, this does not allow for the benefits of autonomy. Contrary to Bruffee's recommendation, I'd like to sit in with the group this week and work through a problem with them. I do fear that my presence will remove the semi-autonomous nature of the group, but I think that if I'm there for the entire discussion, don't know the answer either, and am sitting at the table rather than standing, it will be more natural. Regardless, it will be critical to avoid taking too much authority in directing the group for it to be effective, and I will be carefully consider my actions in the moment to avoid pitfalls.

The second challenging group is comprised of five members, where two are in a relationship. Not unexpectedly, the two in a relationship tend to gravitate towards each other in group discussions, while ignoring the others. This past week, when another member at the table flagged me over to ask a question, it turned out the girlfriend had the same question and let me know. After I finished my explanation, I asked if I could still help her, but I was cut off by the boyfriend who denied any help. I waited for an answer from her, but he again spoke up on her behalf before the girlfriend said she would simply forget about the question as it was an extension anyways.

On a personal level, I don't agree with the boyfriend's actions but, divorcing myself from my opinions for a moment to reflect, I think it was clear that the boyfriend was refusing to accept the perceived authority that I had assumed due to the explanation, and imposing that on his girlfriend. It was near the end of class when this

happened, so I didn't try to turn the situation around or revisit it but, if I had a second chance, I would now do things differently. First, I would have reorganized the situation to include the girlfriend in the discussion. By avoiding a chance for the boyfriend to speak up, I think it would ensure that her ZPD is not disrupted and she is allowed to freely explore the topic. Second, to more directly address the authority situation, I would like to rephrase the conversation to the rest of the table as well. This has worked well for me in the past with prideful individuals, but I forgot to do so here.

5.3 Critical Reflection 3

The week before reading break, everyone in my host class was more stressed than normal. The first midterm was coming up that Friday, and so people were asking me more questions individually instead of as a group. I don't mind them asking questions like this, even though the class is designed for them to ask their table group, because there's some benefits to answering questions one on one. Firstly, when it's not a question that many people have, it's often faster to explain it to one person rather than a group, and it can reduce distractions in the classroom for others. One of the most important reasons why I think they're useful, however, is that it can also be much less intimidating than asking a group.

Anxiety when speaking to a group is quite common, and I would imagine that it's even more common when you're admitting that you don't know something. There's a certain amount of embarrassment that goes along with the situation that makes people less forthcoming since it's possible that is something trivial to everyone else. Students might also have felt that they are inconveniencing the others and move onto another topic for their sake. I personally feel more intimidated when sharing anything with a group, even when it's something that I understand. I think there's a couple of perspectives that might support breaking out into a one on one discussion. First of all, from the perspective Vygotsky's ZPD, reducing anxiety allows a ZPD to be more effective, and by asking a question one on one instead of to a group, one can avoid some anxiety. Secondly, as Kenneth A. Bruffee brings up in *The Art of Collaborative Learning*, to have effective collaboration there must be consent between all parties and there is an implied authority that is bestowed upon the others. Bestowing this authority is sometimes hard when considering social and power dynamics, therefore making it easier to go to a single, trusted party.

Bruffee's article also talks about re-acculturation to foster a proper collaborative environment, which one might perceive as being undermined by answering questions one on one. I acknowledge that this might be the case if done regularly or without reason, but I think it still has its place when in the context of something like midterm prep. Especially with the volume of different questions, speed is of the essence and students can sometimes get impatient if they are forced to listen to explanations which they have already learnt. In consideration of this and the above, I think that as long as it's not excessive, one on one discussions in a collaborative classroom have their uses.

As an example, there was one student this week who had a question which took a particularly long time to

answer, since he was asking about a concept that we had already covered in class, but he had some misconceptions about how it's supposed to be applied. As we were working through the question, I made sure to not assume what he knew about the material and asked a lot of questions about where he was finding friction. Through this, I discovered that his misconceptions ran fairly deep and he needed to go back to some of the math. I was really impressed at the time with the way he tackled it. When we were going through it, although he seemed somewhat discouraged as we were first exploring the question, he kept at it and rebounded quite quickly. After reading the paper by Jennifer Mangels et al., the way in which he was asking questions makes me believe that he was a more of an incremental theorist than an entity theorist. By keeping an open mind to the information that he was receiving, and not dismissing it or disregarding it because he had given up hope for the midterm, he was able to successfully gain new information.

I admire his ability to do this only a couple of days before he had a test, as he must have been aware that he didn't understand some of these things from previous group discussions. I would imagine that an entity theorist would be particularly demotivated from the others understanding the concepts so quickly, and they may not even have asked me for clarification. Asking me one on one demonstrated that he did not believe that it was impossible to learn this knowledge. It also showed other forms of wisdom because, had he asked his table group, I'm sure the problem would have been worked over without as much depth. As good as collaboration is, most students haven't been trained, nor are they trying to find all of each others misconceptions to the same degree as a peer mentor. Once a solution has been found, the group generally counts the problem as solved and they will move on.

5.4 Critical Reflection 5

This time of the semester is usually the most stressful for both teachers and students. It's easy to see in how both act in the classroom. One of the most obvious signs that workloads are getting a bit crazy is when attendance goes down. It's pretty easy to tell in lecture when people have assignments or midterms in other classes because, on those days, about a third of the class doesn't show up. I can empathize with them, even though I'm one of those students who won't miss a lecture even if my workload is insane. Personally, I find that missing a lecture changes the classroom environment because I'm no longer able to contribute to discussion going on around me. I'm stuck at a different step of learning than the others are, and I'm not necessarily getting the help I need to catch up to them. When students miss lecture in my host class, they lose out on the scaffolding provided by worksheets and clicker questions. These students often have no idea how to approach the question, much less participate in meaningful discussion.

I think that Peter Jarvis' approach to learning really applies here, and that there's a interplay in between which part of the model a student is in and how well they can participate in discussion. Obviously, students who miss lecture are experiencing a disjuncture as they become aware of what the professor is asking them to do. Due to

this, they need more scaffolding or other resources such that they can tackle the problem. This is contrasted with those who do attend lectures, because these students will move past the awareness part of the model in a flash, and move straight towards reflection. These two contrasting contexts demand different forms of help from myself, and understanding what they might be experiencing through Jarvis' perspective can help me to individualize my approach as much as possible. Sometimes I'm lucky and there's a few people in each stage at a table who I can group together so that they can help each other. Sometimes, however, I'm not so lucky. When one student is much further behind another my focus shifts towards leading those individuals towards where the other students are. Individual support can help them to progress really quickly. The case in which there is one students who is further ahead of the group in the learning process is a very different case as well, something that occurs more rarely at this time of year but still can if the rest of their table group hadn't shown up the previous lecture.

Unfortunately, for those skipping some lectures, there were many misconceptions as we were approaching the midterm this past Friday. This was apparent to us though the clicker questions, which we use in class, as some of the questions had most of the class on the wrong answer. I think Jack Mezirow's theories on reference frames applies both literally and figuratively in this case. In physics, we must change in between reference frames on a whim to visualize physical effects on particles. To be able to do this, students must challenge what they were visualizing in their original reference frame to accurately simulate what's happening in the new reference frame. Not only does this work for particles, but it's also great practice for them to critically analyze their perspectives on different subjects. Here, I find it critical that students are matched up with other who are at the same stage of learning as them because only then are they able to properly challenge and question each other. When one-on-one with a student, I can make sure that this is the case, but with so many students in the class, it's much easier for myself if I can spark a discussion between two people and then move onto the next group.

If I'm honest, this isn't always the most efficient solution as students tend to get off track often, but this seems to be getting better as time passes. In a sense, they're also changing frames of reference throughout the semester towards one that promotes more collaborative work. They seem to be seeing more value in working together, and they seem to realize that they're learning more because of it. I don't know that they're thinking of it in terms of critically reflecting on their assumptions and frame of reference, but instead I believe that they want others to find their mistakes (if only from the perspective that it's easier to have someone else find them than to find their own). Overall, I think my host class is moving towards a more holistic approach to learning through collaboration. By recognizing the complex nature of learning, I can help them towards this more efficiently as a peer mentor as well.

5.5 Critical Reflection 6

In this course, we not only talk about mentoring, but we also talk about the structure of a classroom. In the context of this class, I believe it's because, in some aspects of our mentoring, it's important for us to be aware of how to

structure a lesson or how our actions shape the learning environment. When we've covered a topic so extensively in class, however, I find it hard not to apply it to other aspects of our mentoring. That's what I find myself doing as we near the end of this semester, applying what we've learnt not to students or situations that crop up during my mentoring, but to the classroom itself. In this reflection, I'd like to put to paper some of the opinions that I've formed about how my host host class is presented based on feedback from the students, frame it using the context of some of the authors we've covered this semester, and address the apparent dichotomy of these authors and student opinion on his methods.

Students have a habit of complaining, admittedly myself included. But this considered, I've still received a lot of negative feedback with regards this semester with regards to the structure of the classroom. More specifically, a lot of the complaints that I've heard revolve around the use of worksheets, clicker questions and assignments. Students complain that the combination of worksheets and clicker questions makes it hard to take notes in the class, and they leave feeling as if they know the subject only to be unsure of where to start on the assignments and tests. Later in the semester, a common complaint was the pacing of the lectures and how much time was spent on certain topics when topics down the road suffer because of it. Many students, I've been told, would prefer a more traditional classroom.

This being said, I've seen many authors this semester write about concepts which seem to support Dr. Donev's methods. The Art of Collaborative Learning talks about the importance of working in a group, as we do with the worksheets. The Nature of Learning touches on the social nature of learning and formative assessment, which is put into practice in our classrooms using clicker questions. We then saw the importance of scaffolding from Vygotsky on Education, which further supports the combination of the worksheets and assignments. I'm sure I could find some way to support Dr. Donev's choices from all of the texts we've studied this semester. Even so, the number of complaints and the conviction of those complaining has lead me to believe that this is not simply a case of the students needing re-acculturation. Especially at the end of the term, when I've seen the students grow into this collaborative classroom and benefit from it, I don't believe that the solution lies solely on them as individuals. Yet, I also don't believe that the methods used in this classroom should be discarded.

In my opinion, I feel as if the different aspects to the course are not conscious of the time it takes for students to go through their learning cycles. Jarvis' theories expanding on the Kolb cycle tell us that human learning depends not only on experience, reflection and experimentation, but also on time, emotion and overcoming disjuncture. When students are presented with disjucture in the classroom, whether it be through lecture slides, worksheets or clicker questions, and they tell me after the fact that they wish they had time to take notes, this says to me that there was not enough time for students to internalize the topic and reset their cycle before we move onto the next topic. If they need to bring home notes even when the lecture slides are posted, I believe that they're trying to leave themselves a bookmark of sorts to complete their cycle. Concurrently, when I'm told at the end of the semester that

they wish the lectures moved faster so that the last few lectures are less of a crunch, it tells me that they've now had the opportunity to reflect on what they learnt and believe that they could and should have covered it more quickly.

This conflict seems to me like a problem which needed to be addressed, but to which there is no clear answer from my current knowledge. The students are obviously at two different points in Jarvis' cycle when they have provided me with this feedback, and the disconnect in the middle appears to be time. Therefore, without believing this to be a perfect solution, I think that restructuring the flow of the components with Vygotsky's zone of proximal development (ZPD) in mind could be of help. It seems to me that increasing the flow between the component of the classroom could, in turn, help to facilitate the flow of the individual's learning cycle. For example, the worksheets are borrowed from another class, and assignments can often feel disjointed from the methods used there. The clicker questions are written to follow the same topics as the worksheets, and therefore the learning process for assignments and the classroom feel separate. If the worksheets and assignments were restructured such that the worksheets and clicker questions led naturally into the assignments, the assignments would feel easier, the ZPD of the students would be continuously increasing, and students simultaneously might be able to cover material faster and not feel as if they need to revisit their notes from a class since they're simply continuing their reflection on a topic through the assignment. Though a very simplistic solution, this follows the intuition I've developed this semester.

6 Facilitated Class

Facilitating a class was a part of CMCL that all students had to complete. In doing this, I had to apply what I had learnt about classrooms to lecturing my peers. This helped my understanding of how to create an effective presentation, how to lead a discussion with the whole class, how tools can help learning, and how to purposefully choose activities. All in all, this was a very practical and hand-on application of what we had learnt up to this point in the semester.

6.1 Lesson Plan

6.1.1 Learning Outcomes

By the end of the facilitated class, learners will be able to:

1. Appreciate the contributions of bell hooks to adult learning;
2. Identify the elements of teaching methods that can help instructors connect to their students (pathos, ethos, logos);
3. Understand the distinction between the message of a lesson and the delivery of that message;

4. Articulate why connecting personal experience to classroom learning is an effective method of instruction;

5. Apply bell hooks' ideas about engaged pedagogy by engaging in respectful debate with peers about an issue.

6.1.2 Lesson Activities

1. Lesson outline, Introduction to bell hooks (5 minutes) (Helen)

2. Introduction of logos, pathos, ethos (5 minutes) (Nathan)

3. Activity 1 - comparing two different articles (5 minutes) (Aliza and Nathan)

4. Thoughts about the article (10 minutes) (Mahrukh)

5. Class debate (Helen and all)

6. Introduction (5 minutes)

7. Debate (20 minutes)

8. Debrief (10 minutes) (Aliza and all)

6.1.3 Tools Used

Although there is a certain amount of information that we want to convey to the class, such as details about bell hooks or the main points of the article (hooks, 1994), we plan to engage in learner-centered, collaborative learning (CERI, 2010). We will achieve this with a number of active learning techniques (CFE, 2009). In Activity 1, we plan to engage the class in small groups, asking them to identify the differences in argumentation techniques between two articles about the same topic. Even though the activity is simple, discussing with a group of peers will help the class think more deeply about the concepts we will ask them to apply (CERI, 2010, pp. 2). Our main activity, Activity 2, is a whole-class debate. Drawing from traditional debate formats, we will ask the class to work as a team to present arguments from each side of an issue: whether public schools should implement uniforms. We will allow one side to use arguments from their personal experience, whereas the other side will only be able to use arguments based on fact or abstract knowledge. We hope that this activity will allow the class to both engage in collaboration and appreciate the value of drawing upon personal experience when presenting knowledge to a classroom.

6.1.4 Motivation

We modelled this lesson after our personal learning experiences and bell hooks' own vulnerability. All of us were swayed by hooks' reflective style of writing and her descriptions of her demonstrations of vulnerability in the

classroom. While collaborative learning and class participation is at the core of our lesson, we have also attempted to embody bell hooks' statement: "When education is the practice of freedom, students are not the only ones who are asked to share, to confess" (hooks, 1994, pp. 21). We have tried to integrate drawing upon personal experiences while presenting the lesson to engage in equal dialogue with the rest of the class. For example, Nathan will be presenting upon the modes of persuasion (ethos, pathos, and logos) and Helen will be introducing hooks, which we had learned about in previous classes and felt strongly about. Drawing upon our previous experiences and making horizontal connections while presenting our lesson will give the lesson some of the authenticity that hooks describes in the article.

6.1.5 References

- Center for Educational Research and Innovation. (2010). The Nature of Learning: Using Research to Inspire Practice. Retrieved from http://www.oecd.org/education/ceri/50300814.pdf
- Center for Faculty Excellence. (2009). Classroom Activities for Active Learning. Retrieved from https://cfe.unc.edu/files/2
- hooks, b. (1994). Engaged Pedagogy. In Teaching to Transgress (pp. 13-22). New York: Routledge.

6.2 Link to Presentation Slides

Google slides:
https://docs.google.com/presentation/d/1Tk2QLpp3gMruSxYkFSBxwcE-j0l7ANHp4IzF9Fac1AA/edit?usp=sharing

6.3 Presentation Feedback

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

   ↳ I really enjoyed the activity

2. Which aspect of the student facilitated class was least valuable to you?

   N/A .

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	SA	A	D	SD
b. The class met my expectations	SA	A	D	SD
c. The facilitators communicated effectively	SA	A	D	SD
d. The level of information was appropriate	SA	A	D	SD
e. The class stimulated my interest	SA	A	D	SD
f. The class activities were useful	SA	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

- great background on Hooks!
- great job bringing in your understanding of the topics (Ethos, Logos, etc)
- loved the debate as a real example of the ideas presented by hooks

2. Which aspect of the student facilitated class was least valuable to you?

- I wasn't able to follow the connection between the first activity to the paper but I struggled with understanding the article to its fullest so this may be on me!

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	(SA)	A	D	SD
b. The class met my expectations	(SA)	A	D	SD
c. The facilitators communicated effectively	(SA)	A	D	SD
d. The level of information was appropriate	(SA)	A	D	SD
e. The class stimulated my interest	(SA)	A	D	SD
f. The class activities were useful	(SA)	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	SA	A	D	SD
Presenters' Questions	SA	A	D	SD
Class Activity	SA	A	D	SD
Class Discussion	SA	A	D	SD
Other students' questions	SA	A	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

Great Job

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	(SA)	A	D	SD
Presenters' Questions	(SA)	A	D	SD
Class Activity	(SA)	A	D	SD
Class Discussion	SA	(A)	D	SD
Other students' questions	(SA)	A	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

   The debate

2. Which aspect of the student facilitated class was least valuable to you?

   The first activity

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	(SA)	A	D	SD
b. The class met my expectations	(SA)	A	D	SD
c. The facilitators communicated effectively	(SA)	A	D	SD
d. The level of information was appropriate	(SA)	A	D	SD
e. The class stimulated my interest	SA	(A)	D	SD
f. The class activities were useful	SA	(A)	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	(SA)	A	D	SD
Presenters' Questions	(SA)	A	D	SD
Class Activity	(SA)	A	D	SD
Class Discussion	(SA)	A	D	SD
Other students' questions	SA	(A)	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	(SA)	A	D	SD
Presenters' Questions	(SA)	A	D	SD
Class Activity	(SA)	A	D	SD
Class Discussion	(SA)	A	D	SD
Other students' questions	SA	(A)	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

Debate was great

2. Which aspect of the student facilitated class was least valuable to you?

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	(SA)	A	D	SD
b. The class met my expectations	(SA)	A	D	SD
c. The facilitators communicated effectively	(SA)	A	D	SD
d. The level of information was appropriate	(SA)	A	D	SD
e. The class stimulated my interest	(SA)	A	D	SD
f. The class activities were useful	(SA)	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	SA	A	D	SD
Presenters' Questions	SA	A	D	SD
Class Activity	SA	A	D	SD
Class Discussion	SA	A	D	SD
Other students' questions	SA	A	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

- the ~~class~~ debate was an excellent exercise to see Aristotle's ethos, logos & pathos principles. in action.

2. Which aspect of the student facilitated class was least valuable to you?

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	(SA)	A	D	SD
b. The class met my expectations	(SA)	A	D	SD
c. The facilitators communicated effectively	(SA)	A	D	SD
d. The level of information was appropriate	(SA)	A	D	SD
e. The class stimulated my interest	(SA)	A	D	SD
f. The class activities were useful	(SA)	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	SA	A	D	SD
Presenters' Questions	SA	A	D	SD
Class Activity	SA	A	D	SD
Class Discussion	SA	A	D	SD
Other students' questions	SA	A	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

Great jobs!
- Give us more time to debate / reversing limitations

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

   - Debate
   - Taking time to listen to opinions

2. Which aspect of the student facilitated class was least valuable to you?

   N/A

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	SA	A	D	SD
b. The class met my expectations	SA	A	D	SD
c. The facilitators communicated effectively	SA	A	D	SD
d. The level of information was appropriate	SA	A	D	SD
e. The class stimulated my interest	SA	A	D	SD
f. The class activities were useful	SA	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	SA	A	D	SD
Presenters' Questions	SA	A	D	SD
Class Activity	SA	A	D	SD
Class Discussion	SA	A	D	SD
Other students' questions N/A	SA	A	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

Good work!
The debate was
tons of fun!

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

the debate was fun!

2. Which aspect of the student facilitated class was least valuable to you?

The 1st activity! I didn't have time to read it :)

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a.	The class helped me better understand the topic	SA	A	D	SD
b.	The class met my expectations	SA	A	D	SD
c.	The facilitators communicated effectively	SA	A	D	SD
d.	The level of information was appropriate	SA	A	D	SD
e.	The class stimulated my interest	SA	A	D	SD
f.	The class activities were useful	SA	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

Debate was fun!
Aristotle connection was great.

2. Which aspect of the student facilitated class was least valuable to you?

NA.

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	SA	A	D	SD
b. The class met my expectations	SA	A	D	SD
c. The facilitators communicated effectively	SA	A	D	SD
d. The level of information was appropriate	SA	A	D	SD
e. The class stimulated my interest	SA	A	D	SD
f. The class activities were useful	SA	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

The debate was super great

2. Which aspect of the student facilitated class was least valuable to you?

The first activity

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	SA	A	D	SD
b. The class met my expectations	SA	A	D	SD
c. The facilitators communicated effectively	SA	A	D	SD
d. The level of information was appropriate	SA	A	D	SD
e. The class stimulated my interest	SA	A	D	SD
f. The class activities were useful	SA	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

The debate

2. Which aspect of the student facilitated class was least valuable to you?

The logos, ethos, pathos, I failed to see the connection w/ the reading. I saw some connection but I didn't think it would've been a central point

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	SA	A	D	SD
b. The class met my expectations	SA	A	D	SD
c. The facilitators communicated effectively	SA	A	D	SD
d. The level of information was appropriate	SA	A	D	SD
e. The class stimulated my interest	SA	A	D	SD
f. The class activities were useful	SA	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

   The debate & Reading Outline

2. Which aspect of the student facilitated class was least valuable to you?

   N/A.

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	SA	A	D	SD
b. The class met my expectations	SA	A	D	SD
c. The facilitators communicated effectively	SA	A	D	SD
d. The level of information was appropriate	SA	A	D	SD
e. The class stimulated my interest	SA	A	D	SD
f. The class activities were useful	SA	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	SA	A	D	SD
Presenters' Questions	SA	A	D	SD
Class Activity	SA	A	D	SD
Class Discussion	SA	A	D	SD
Other students' questions	SA	A	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

The debate; b/c it showed how hard it is to disentangle personal experiance

2. Which aspect of the student facilitated class was least valuable to you?

Nothing that comes to mind.

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	SA	(A)	D	SD
b. The class met my expectations	SA	(A)	D	SD
c. The facilitators communicated effectively	SA	(A)	D	SD
d. The level of information was appropriate	SA	(A)	D	SD
e. The class stimulated my interest	SA	(A)	D	SD
f. The class activities were useful	SA	(A)	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

Please turn over

4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	SA	A	D	SD
Presenters' Questions	SA	A	D	SD
Class Activity	SA	A	D	SD
Class Discussion	SA	A	D	SD
Other students' questions	SA	A	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

Peer Feedback Form (CMCL 507/SCIE 511)

1. Which aspect of the student facilitated class was most valuable to you?

The Second Activity

2. Which aspect of the student facilitated class was least valuable to you?

N/A

3. Use the following scale and circle the extent to which you agree with each statement.

SA=Strongly Agree	A=Agree	D=Disagree	SD=Strongly Disagree

a. The class helped me better understand the topic	(SA)	A	D	SD
b. The class met my expectations	(SA)	A	D	SD
c. The facilitators communicated effectively	(SA)	A	D	SD
d. The level of information was appropriate	(SA)	A	D	SD
e. The class stimulated my interest	(SA)	A	D	SD
f. The class activities were useful	(SA)	A	D	SD

If you answered Disagree or Strongly Disagree for any of the items, please indicate why in the space below:

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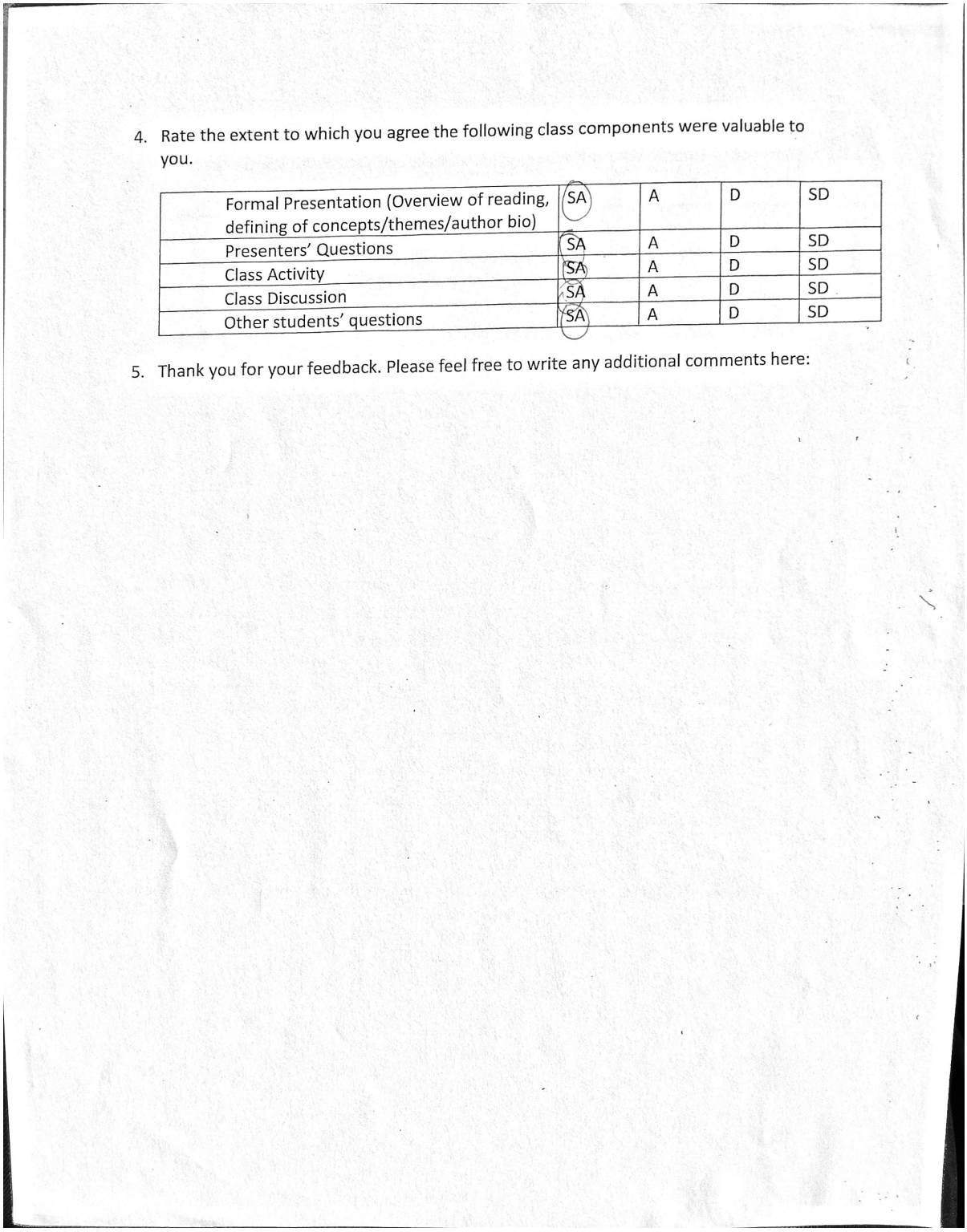


4. Rate the extent to which you agree the following class components were valuable to you.

Formal Presentation (Overview of reading, defining of concepts/themes/author bio)	SA	A	D	SD
Presenters' Questions	SA	A	D	SD
Class Activity	SA	A	D	SD
Class Discussion	SA	A	D	SD
Other students' questions	SA	A	D	SD

5. Thank you for your feedback. Please feel free to write any additional comments here:

7 Host-Class Activities

Our host instructor has, over the past two years, made an effort to incorporate more active components into the classroom. Our primary responsibilities were working with groups of students on clicker questions and worksheets

during lecture, to help guide the discussion. Much of this provides context to my reflection and opinions on peer mentoring expressed elsewhere in this document, but it also shows how I was working with material that directly related to CMCL 507 and guided my growth in class.

7.1 Clicker Questions

Clicker questions were a diagnostic tool which we used in class to receive real-time feedback on how concepts were being understood. We often found that what we expected people to answer correctly often did not match up with what they did. This was a key method of informing what Aran and I would talk to groups about, as we were able to target areas where people had misconceptions more efficiently. By looking over people's shoulders at their phones while they answered, we could also see if everyone at a table group agreed, or if the table group was leading each other astray. Overall, clicker questions proved an integral part of our work as peer mentors. I have included three example questions (out of approximately 80 over the semester) that represent the style of some of the questions used.

7.1.1 Example Question 1

Car & truck collide

A compact car and a large truck collide head on and stick together. Which undergoes the larger magnitude momentum change due to the collision?

A) car

B) truck

C) The magnitude of the momentum change is the same for both vehicles.

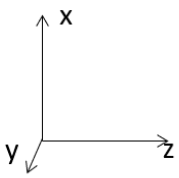
D) Can't tell without knowing the final velocity of combined mass.

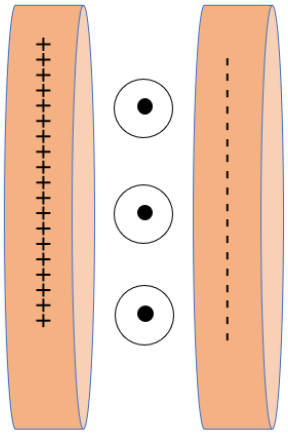
7.1.2 Example Question 2

Momentum in the fields:

$$\frac{\vec{p}}{\text{volume}} = \vec{g} = \frac{1}{c^2}\vec{S} = \mu_0\epsilon_0\vec{S} = \epsilon_0\vec{E}\times\vec{B}$$

Consider a charged capacitor placed in a uniform B field in the +y direction





Which way does the stored field Momentum in this system point?

A) + x
B) - x
C) + y
D) - y
E) + z
F) - z

7.1.3 Example Question 3

The ij^{th} component of the Maxwell stress tensor $\overleftrightarrow{T}$ is given by:

$$T_{ij} = \epsilon_0 \left(E_i E_j - \frac{1}{2}\delta_{ij} E^2 \right) + \frac{1}{\mu_0}\left(B_i B_j - \frac{1}{2}\delta_{ij} B^2 \right)$$

What is the E field part of the T_{zx} term?

A. $\epsilon_0 \left(E_z E_x - \frac{1}{2}(E_x^2 + E_z^2) \right)$

B. $\epsilon_0 \left(E_z E_x - \frac{1}{2} E_y^2 \right)$

C. $\epsilon_0 \left(E_z E_x - \frac{1}{2}\left(E_x^2 + E_y^2 + E_z^2 \right) \right)$

D. $\epsilon_0 (E_z E_x)$

E. None of the above

7.2 Worksheets

Worksheets were the second method of active participation in Dr. Donev's classroom. Though not made by Aran and myself, we've come to know them inside and out by first being student in the course last year, and now guiding students though them. When we first started, facilitating groups of students working on these worksheets felt foreign to us. Personally, I was unsure of how to approach the students when they were in the middle of working on them. As we progressed, however, I started to focus not on the content itself, but on the intent of the activity. These worksheets allow for a few different approaches which I discussed in the reading summaries and critical reflections, and I enjoyed wandering around the class to become a part of different learning groups. I have included below the first five worksheets we used, which I believe represent the styles of the worksheets that we saw overall: mathematical derivation, conceptual, drawing, a mixture of all three, and a thought experiment.

7.2.1 Worksheet 1

Name_____
457-0A Divergence and Stokes' Theorems

Topics: Divergence theorem, Stokes' theorem, Gauss' law, Ampere's law.

As with all of the worksheets, try to do this without referring to your notes, book, the internet! (You can ask the prof for a hint.)

1. Begin by writing down the divergence theorem. (Try without asking your neighbours either, if you get stuck, ask for a hint.)

The integral form of Gauss' law is:

$$\oint_S \vec{\mathbf{E}} \cdot d\vec{\mathbf{A}} = \frac{Q_{\text{enclosed}}}{\epsilon_0}$$

2. Write down the relationship between Q_{enc} and charge density ρ.

3. Use the divergence theorem to *derive* the differential form of Gauss' law from the integral form. Be sure to briefly explain each of your steps.

4. Now, write down Stokes' theorem (the "curl theorem"). Again, try to do this without referring to your notes (or phone, etc.).

5. The integral form of Ampere's law is:

$$\oint \vec{\mathbf{B}} \cdot d\vec{\mathbf{l}} = \mu_0 I_{\text{enc}}$$

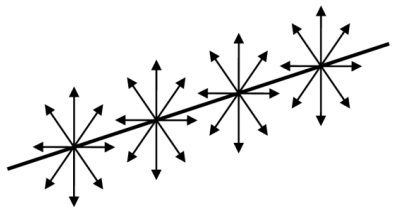
Write down the relationship between I_{enc} and the current density $\vec{J}$.

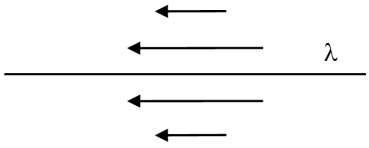
6. Use Stokes' theorem to *derive* the differential form of Ampere's law from the integral form. Be sure to briefly explain each of your steps.

7.2.2 Worksheet 2

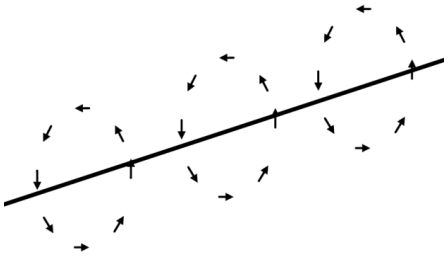
Name_____
Physics 457, Winter 2018, 0B Gauss' Law
Topics: Gauss' law, symmetries, electric field from a line charge distribution.

Symmetries: Consider a long straight wire with uniform charge per unit length l. We will use Gauss' law to determine the electric field around the wire. Usually, we begin by assuming that the electric field around the charged wire is entirely in the *radial* direction.

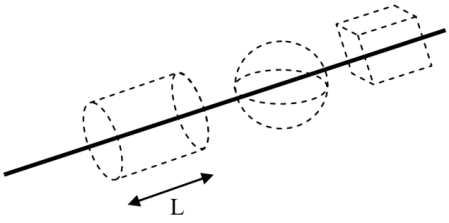




1. Give a brief <u>symmetry</u> argument for why the electric field should *not* have a *longitudinal* component (parallel with the wire).



2. Give a brief <u>symmetry</u> argument for why the electric field should *not* have a *tangential* component (circling around the wire).



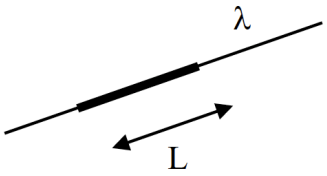
3. Assuming the electric field *is* purely radial, why would we choose an imaginary *cylinder* as our Gaussian surface? Why not a *sphere* or a *cube*?

Name_____
Physics 457, Winter 2018, 0B Gauss' Law

4. Here is Gauss' law in *differential* form: $\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\epsilon_o}$

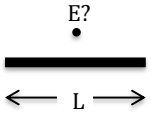
Now, write down Gauss' law in *integral* form.

5. Consider an infinitely long wire, with uniform charge density λ. What is the total charge on a small *section* of this wire of length **L**?



6. Use Gauss' law in integral form to solve for the electric field at any point around the wire. Briefly define any symbols you use.

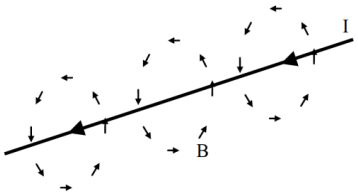
7. **Challenge Question** (for really fast teams!) If the wire was not infinite, but in fact was ONLY a segment of length L, would the formula you found above still hold, assuming you only want to know the E field around the exact midpoint of the wire segment? Why/why not?



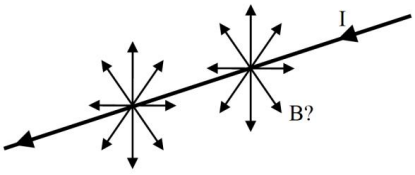
7.2.3 Worksheet 3

Name_____
Physics 457, Winter 2018, 0C Ampere's Law
Topics: Ampere's law, symmetries, magnetic field of a long wire.

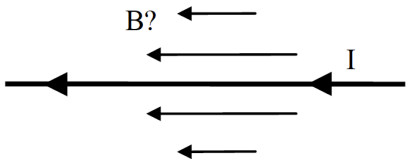
We will use Ampere's law in integral form to determine the magnetic field around a long straight wire, carrying a current I. Usually, we begin by assuming that the magnetic field around the current-carrying wire is entirely in the *tangential* direction.



1. Give a brief argument for why the magnetic field should *not* have a *radial* component (outwards from the wire).



2. Can you give a brief argument for why the magnetic field should *not* have a *longitudinal* component (parallel with the wire)?

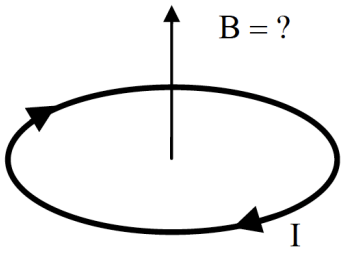


Here is Ampere's law in *differential* form: $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$

3. Now, write down Ampere's law in *integral* form.

4. Use Ampere's law in integral form to solve for the magnetic field around the wire. Briefly define any symbols you use.

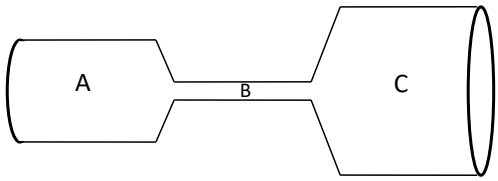
5. **Challenge Question:** (for the really fast teams) Can we use Ampere's Law to compute the B-field *at the center* of a circular current-carrying loop of wire? Why or why not? (If so, do it. If not, then how *could* you calculate the field there?)



7.2.4 Worksheet 4

Sheet 7.1.1a Ranking sizes Name_____

A copper cylinder is machined to have the following shape. The ends connect to a battery so that a current flows through the copper.



Rank order (from greatest to smallest, e.g. D=E>F) and give one sentence explaining why.

Magnitude of E field

Conductivity

Current

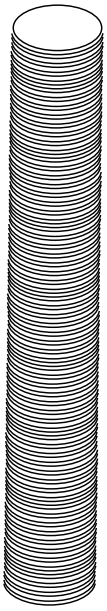
Current Density

What order did you rank these in (which problem did you do first, second, third etc.)

7.2.5 Worksheet 5

PHYS 457 07.2.1, Faraday's law Name_____

Consider a very long solenoid of radius ***R***, with *n* turns per unit length and carrying a current *I*.



(A) Make a sketch of the *magnitude* of the B-field as a function of distance from the center, both inside and outside the solenoid.

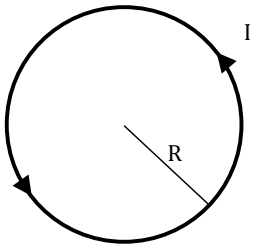
(B) From Ampere's Law, one can show that the B-field inside the solenoid is $B = \mu_o nI$. [prove this later at the end, if you have extra time.]

Suppose the current *I* in the coil of wire initially starts at a large value and is decreasing with time, so that the *B-field decreases* inside the solenoid according to the equation $B = B_0 - Ct$ (where C is a positive constant with appropriate units). Where in space is the $\vec{\boldsymbol{E}}$ *zero*, and where is it *non-zero*?
[Inside the solenoid? Outside? Everywhere?]

Make a quick sketch of what you think this induced E-field would look like. Just use your intuition for now, and we'll check with calculations later.

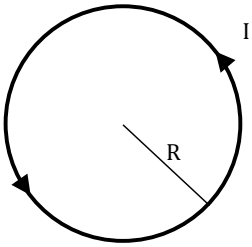
(C) Use Faraday's law in integral form to compute the electric field *inside* the solenoid. Be sure to specify in the diagram the surface you're using for the integrals, and the direction of the induced $\vec{E}$.

$$\oint \vec{E} \cdot d\vec{l} = -\frac{d}{dt}\int \vec{B} \cdot d\vec{a}$$



Top View of Solenoid

(D) Use Mr. Faraday to compute the $\vec{E}$ *outside* the solenoid.



Top View of Solenoid

(E) Make a sketch of the magnitude of the $\vec{E}$ as a function of distance from the center, both inside and outside the solenoid.

7.3 Midterm Preparation Videos

As a part of our responsibilities in the classroom, Dr. Donev asked Aran, the TA and I each to create video solutions for the practice tests. Aran did the first midterm, myself the second and the TA the final. These videos were a very

new and different experience to me, and I found myself enjoying the process of preparing my notes for the video. One aspect on which I focused during these videos was not necessarily being perfect, but aiming to prevent students watching from making the same mistakes that I did. It's for that reason that at several points in the videos when I've made a mistake, I keep going and correct myself so that the viewers can see how I correct it. Below are the link to all four video answers, as well as the practice midterm itself.

7.3.1 Youtube Videos

- Question 1 https://youtu.be/bVq38Hokt5k
- Question 2: https://youtu.be/O4bAErgwFuc
- Question 3: https://youtu.be/JZem5Njf_Os
- Question 4: https://youtu.be/I-K0gkcQ_XA

7.3.2 Practice Midterm 2

Name_____

UNIVERSITY OF CALGARY

FACULTY OF SCIENCE

PRACTICE Midterm Examination #2

PHYS 457

DATE: practice for midterm March 22nd, 2019 TIME: 50 minutes

This is a closed-book examination. The use of camera devices, MP3 Players and headphones, or wireless access devices such as cell phones, Blackberries, etc., during the examination will not be allowed. Calculators are allowed for this examination. Show your work for partial credit.

Instructions:
Remove the equation sheet (the last page) then please put your name on all remaining pages.

Name_____

1. Expressions are given below.
   a. (12 points) Which of these expressions satisfy the wave equation? Explicitly state whether each expression does or does not satisfy the wave equation.
   b. (8 points) Find the wave speed for whichever expressions satisfy the wave equation.

$f_1(x,t) = \sin(4x + t^2)$

$f_2(x,y,z,t) = \cos\big((\hat{x} + 2\hat{y} - 2\hat{z}) \cdot \vec{r} - 6t\big)$

$f_3(x,t) = (2x - 3t)^4 + t^2$

$f_4(x,t) = 9x^2 - 6x + t^2$

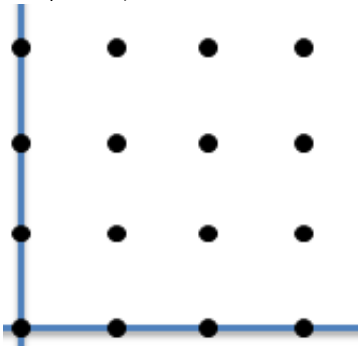
2. Given the equation: $\tilde{\vec{E}} = (1 + 2i)(\hat{x} + 2\hat{y})\exp[i(2x - y + \pi t)]$, there are appropriate units to make all of these numbers work out properly. Find the following for this wave:
   a. (8 points) The amplitude

Name_____

b. (8 points) Given the equation: $\tilde{\vec{E}} = (1 + 2i)(\hat{x} + 2\hat{y})\exp[i(2x - y + \pi t)]$, find the phase constant (we called this δ in class).

c. (4 points) The polarization direction.

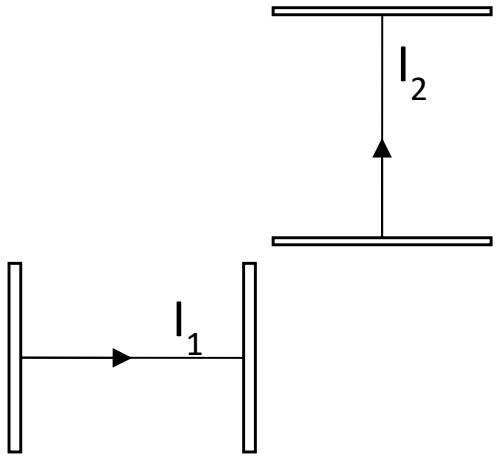
d. (8 points) Draw two of the planes for this wave (the dots below represent points in the first quadrant):



3. (12 points) In class we derived the wave equation for $\vec{E}$ from Maxwell's equations in a vacuum. Derive the wave equation for $\vec{B}$ in space from Maxwell's equations.

Name_____

4. Two different capacitors are discharged by placing a wire between the two plates as shown in the figure to the right. Capacitor 1 has current flowing in the $+\hat{x}$ direction, capacitor 2 has current flowing in the $+\hat{y}$ direction.



a. (3 points) What is the direction of the force on the wire in capacitor 1 from the wire in capacitor 2?

b. (3 points) What is the direction of the force on the wire in capacitor 2 from the wire in capacitor 1?

c. (12 points) What does this tell us about the divergence of the Maxwell Stress Tensor $\left(\vec{\nabla} \cdot \vec{\vec{T}}\right)$? Explain how you know.

Name_____

This page may be removed for convenience

Vector identities: $\vec{\nabla}(fg) = f(\vec{\nabla}g) + g(\vec{\nabla}f)$; $\vec{\nabla}\cdot(f\vec{A}) = f(\vec{\nabla}\cdot\vec{A}) + \vec{A}\cdot(\vec{\nabla}f)$;

$$\vec{\nabla}\times(f\vec{A}) = f(\vec{\nabla}\times\vec{A}) - \vec{A}\times(\vec{\nabla}f); \quad \vec{\nabla}\times(\vec{\nabla}\times\vec{A}) = \vec{\nabla}(\vec{\nabla}\cdot\vec{A}) - \nabla^2\vec{A}$$

Cartesian coordinates: $d\vec{l} = dx\hat{x} + dy\hat{y} + dz\hat{z}$; $d\tau = dxdydz$

Gradient: $\vec{\nabla}t = \frac{\partial t}{\partial x}\hat{x} + \frac{\partial t}{\partial y}\hat{y} + \frac{\partial t}{\partial z}\hat{z}$

Divergence: $\vec{\nabla}\cdot\vec{v} = \frac{\partial v_x}{\partial x} + \frac{\partial v_y}{\partial y} + \frac{\partial v_z}{\partial z}$

Curl: $\vec{\nabla}\times\vec{v} = \left[\frac{\partial v_z}{\partial y} - \frac{\partial v_y}{\partial z}\right]\hat{x} + \left[\frac{\partial v_x}{\partial z} - \frac{\partial v_z}{\partial x}\right]\hat{y} + \left[\frac{\partial v_y}{\partial x} - \frac{\partial v_x}{\partial y}\right]\hat{z}$

Laplacian: $\nabla^2 t = \frac{\partial^2 t}{\partial x^2} + \frac{\partial^2 t}{\partial y^2} + \frac{\partial^2 t}{\partial z^2}$

Spherical coordinates: $x = r\sin\theta\ \cos\phi$; $y = r\sin\theta\ \sin\phi$; $z = r\cos\theta\ \cos\phi$

$d\vec{l} = dr\hat{r} + rd\theta\hat{\theta} + r\sin\theta\, d\phi\hat{\phi}$; $d\tau = r^2\sin\theta\, drd\theta d\phi$

Gradient: $\vec{\nabla}t = \frac{\partial t}{\partial r}\hat{r} + \frac{1}{r}\frac{\partial t}{\partial\theta}\hat{\theta} + \frac{1}{r\sin\theta}\frac{\partial t}{\partial\phi}\hat{\phi}$

Divergence: $\vec{\nabla}\cdot\vec{v} = \frac{1}{r^2}\frac{\partial}{\partial r}(r^2 v_r) + \frac{1}{r\sin\theta}\frac{\partial}{\partial\theta}(\sin\theta\, v_\theta) + \frac{1}{r\sin\theta}\frac{\partial v_\phi}{\partial\phi}$

Curl: $\vec{\nabla}\times\vec{v} = \frac{1}{r\sin\theta}\left[\frac{\partial}{\partial\theta}(\sin\theta\, v_\phi) - \frac{\partial v_\theta}{\partial\phi}\right]\hat{r} + \frac{1}{r}\left[\frac{1}{\sin\theta}\frac{\partial v_r}{\partial\phi} - \frac{\partial}{\partial r}(rv_\phi)\right]\hat{\theta} + \frac{1}{r}\left[\frac{\partial}{\partial r}(rv_\theta) - \frac{\partial v_r}{\partial\theta}\right]\hat{\phi}$

Laplacian: $\nabla^2 t = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial t}{\partial r}\right) + \frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(sin\theta\frac{\partial t}{\partial\theta}\right) + \frac{1}{r^2\sin^2\theta}\frac{\partial^2 t}{\partial\phi^2}$

Cylindrical coordinates: $x = s\cos\phi$; $y = s\sin\phi$; $d\vec{l} = ds\hat{s} + sd\phi\hat{\phi} + dz\hat{z}$; $d\tau = sdsd\phi dz$

Gradient: $\vec{\nabla}t = \frac{\partial t}{\partial s}\hat{s} + \frac{1}{s}\frac{\partial t}{\partial\phi}\hat{\phi} + \frac{\partial t}{\partial z}\hat{z}$

Divergence: $\vec{\nabla}\cdot\vec{v} = \frac{1}{s}\frac{\partial}{\partial s}(sv_s) + \frac{1}{s}\frac{\partial v_\phi}{\partial\phi} + \frac{\partial v_z}{\partial z}$

Curl: $\vec{\nabla}\times\vec{v} = \left[\frac{1}{s}\frac{\partial v_z}{\partial\phi} - \frac{\partial v_\phi}{\partial z}\right]\hat{s} + \left[\frac{\partial v_s}{\partial z} - \frac{\partial v_z}{\partial s}\right]\hat{\phi} + \frac{1}{s}\left[\frac{\partial}{\partial s}(sv_\phi) - \frac{\partial v_s}{\partial\phi}\right]\hat{z}$

Laplacian: $\nabla^2 t = \frac{1}{s}\frac{\partial}{\partial s}\left(s\frac{\partial t}{\partial s}\right) + \frac{1}{s^2}\frac{\partial^2 t}{\partial\phi^2} + \frac{\partial^2 t}{\partial z^2}$

Maxwell's equations:

$\vec{\nabla}\cdot\vec{E} = \frac{\rho}{\epsilon_o}$; $\vec{\nabla}\times\vec{E} = -\frac{\partial\vec{B}}{\partial t}$; $\vec{\nabla}\cdot\vec{B} = 0$; $\vec{\nabla}\times\vec{B} = \mu_o\left(\vec{J} + \epsilon_o\frac{\partial\vec{E}}{\partial t}\right)$

$\oint_S \vec{E}\cdot\hat{n}da = \frac{1}{\epsilon_o}Q_{enc}$; $\oint_S \vec{B}\cdot\hat{n}da = 0$

$\oint_C \vec{E}\cdot d\vec{l} = -\int_S \frac{\partial\vec{B}}{\partial t}\cdot\hat{n}da$; $\oint_C \vec{B}\cdot d\vec{l} = \mu_o\left(I_{enc} + \epsilon_o\int_S \frac{\partial\vec{E}}{\partial t}\cdot\hat{n}da\right)$

$$T_{ij} \equiv \varepsilon_0\left(E_iE_j - \frac{1}{2}\delta_{ij}E^2\right) + \frac{1}{\mu_0}\left(B_iB_j - \frac{1}{2}\delta_{ij}B^2\right); \qquad \vec{S} = \frac{1}{\mu_0}(\vec{E}\times\vec{B}) = c^2\vec{g}; \qquad \vec{F} = q(\vec{E} + \vec{v}\times\vec{B})$$

7.4 Midterm Feedback

Below is feedback from my professor from the halfway point of my semester of peer mentoring.

Peer Mentoring Practicum Rubric

Host Instructor: Jason Donev
Host Class: PHYS 457
Peer Mentor: ___ Nathan Meulenbroek

1. In what ways is this Peer Mentor showing excellence in their practicum?
Very prepared, very friendly, helpful. Great attitude!

2. In what ways could this Peer Mentor develop or grow in their practicum?
I could do a better job of sending the clicker questions to them ahead of time. That would help them review a little better, which might make him more comfortable with the material.

In the table below are the specifications for the practicum component of this course. Please indicate whether the Peer Mentor is performing at an "acceptable" or an "unacceptable" level for each of these criteria.
NOTE: An "unacceptable" performance on the final evaluation for any of these criteria will result in the student **failing** the course. Please contact the course coordinator **well before** the final evaluation if you feel the Peer Mentor is not meeting expectations so we can ensure a successful practicum and experience in your course.

A = Acceptable	UA = Unacceptable

a. The Peer Mentor is completing an *average* of 3 hours/week of practicum with the host class providing mentorship to their peers (some weeks may be more than 3 hours, some weeks less, but *on average* the expectation is 3 hours per week)	**A**	~~UA~~
b. The Peer Mentor is attending and is on time for meetings with host instructor (not missing or arriving late to any more than one meeting in the semester **without notice**).	**A**	~~UA~~
c. The Peer Mentor is conducting themselves professionally in interactions and communication with students in the host class and with host instructor.	**A**	~~UA~~

If you selected **Unacceptable** for any of the items, please indicate why in the space below.

Really, he's doing a great job!

Thank you for your feedback. Please feel free to write any additional comments on the back of this form.

Practicum Rubric W17

8 Conclusion

This semester, the work that I've done as a part of CMCL 507 has led to personal growth which I was not expecting. The work summarized in this document paints a picture of how my thoughts on peer mentoring and education have

evolved. As we come to the end of the semester, I've found myself reflecting more richly on problems surrounding learning and education that have been presented to me over the semester. I believe that my thoughts on these have been summarized in a constructive way in my mentoring philosophy. Although, I recognize that there is still room for growth. Completing my practicum in tandem with lecture has not only allowed me to apply all of the things that I have been learning throughout the semester, but reminded me that there are always new problems to solve and that no one solution is a perfect fix. All in all, however, I have thoroughly enjoyed this semester of CMCL 507 and believe that I have learnt knowledge applicable to more than just peer mentoring. I know that I will be able to put the knowledge in this portfolio to good use soon, both for peer mentoring and in my own education.