Report of APAM PhD Qualifying Exam Student Experience

Survey and report administered / compiled by members of the the APAM Graduate Student Association (AMPS) with major contributions by Julia Carmen Hestenes, Andrew Bishop, Dion Ho, and Han Yong Wunrow

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Abstract

In June 2022, the APAM graduate student organization ran a survey to all current PhD students to put on record the general climate surrounding the qualifying exams and to gauge reasonable reforms to the current quals structure, which, to the best of our knowledge, has not had a major structural reform in decades. 74% of all current APAM PhD students responded to the survey. 64.5% of all survey respondents, and 80% of women respondents, wanted written quals to be reformed. 41.5% of "advanced PhD students" (2+ years in APAM) do not think that written quals prepared them for their PhD research and another 36.6% of respondents said that they felt somewhat more prepared but felt there are more effective ways. Materials Science and Applied Physics students had a majority in favor of changing the Oral Exam. Students' mental health testimonials reflected that the cramming required for the qualifying exams produces a lot of stress and anxiety that might be avoided with less memorization-focused exams. Almost half of all respondents, and 9/10 female respondents, reported struggling with mental or physical health in some way during the process of studying for the exams. Multiple students said that they would have left the program if they failed the exam the first time to avoid going through the process again. It became clear from several survey questions that women, the only historically excluded STEM minority group with an adequate sample size, are disproportionately affected by the current quals format compared to the rest of APAM, indicating that APAM's quals are not equitable and interfere with SEAS' mission of creating an inclusive and diverse STEM community that uplifts minorities in STEM. Several minor and major changes to the quals structure were polled and gained majority approval from all respondents. The strong positive response about minor changes (meaning: small revisions to the current format) stresses that the faculty can reasonably make minor reforms by the end of the summer for the incoming class. Students were in favor of replacing the quals with a placement exam (similar to the current format of the GSAS Physics department) or a research/literature-focused examination. This conclusion is supported by student testimonials, which indicated that students find the cramming required for the course-focused written exam not conducive to long-term learning, and the content redundant to course material they have demonstrated competence on while taking the relevant classes.

Contents

List of Figures

1 Summary of Report

The Survey and Demographics
In June 2022, the APAM graduate student organization ran a survey to all current PhD students to examine the climate surrounding the qualifying exams and to gauge reasonable reforms to the current quals structure, which, to the best of our knowledge, has not had a major structural reform in decades. 74% of all current APAM PhD students responded to the survey. Demographics from the survey confirm that APAM lacks a diverse student body, bringing to light that the APAM Faculty should develop an action plan to actively recruit students belonging to historically-excluded minority groups. Of historically excluded minorities in STEM, only women have an adequate sample size (10+ responses).

Effects of the Quals on Attracting Students and Retention of Students
15% of all respondents indicated that they wished that they had given quals more thought when deciding between PhD programs. 13.8% of all respondents, but 40% of women respondents, hesitated to enter into the APAM doctoral program due to quals. 40% of women had considered leaving the program with quals as a consideration, compared to 25% for all of APAM.

Sentiments about relevancy of the qualifying exams and mental health
41.5% of "advanced PhD students" (2+ years in APAM) do not think that written quals prepared them for their PhD research, while separately, 36.6% said that they were somewhat prepared but felt there are more effective ways to prepare. A common complaint among students is that certain qualifying exam topics have no relevance to their research, which also causes them to have less time to take courses on material related to their research. For this reason, it is common for some students to "self-study" some quals topics in their "free time" so that they can take more research-relevant courses or spend more time on research itself. Several suggestions for changing required topics were made by respondents. Students' mental health testimonials reflected that the cramming required for the qualifying exams produces a lot of stress and anxiety that might be avoided with less memorization-focused exams. Several students said they would have left the program if they failed to avoid going through the process again. Almost half of all respondents reported struggling with mental or physical health in some way during the process of studying for the exams, while 9/10 of female respondents report poor mental or physical health in preparing for the exam.

Sentiments on if students want the qualifying exams to be reformed: written vs. oral
64.5% of all respondents, and 80% of women respondents, wanted written quals to be reformed. Because the oral quals vary by program in APAM, responses from each program were evaluated separately. Applied Math students and Plasma physics were unanimously in favor of keeping oral quals as-is. Applied Physics (Solid State and Optical) and Materials Science students were discontented with their oral exams, where they both had the majority in favor of changing or eliminating the oral exam, most citing irrelevance to their research and that they did not learn anything "new" that they hadn't already learned during written quals.

Minor and Major changes to quals

Overall, all respondents were very positive of minor changes to the current exams, indicating that the faculty can at least make minor changes for the incoming students that would greatly improve morale amongst PhDs if the faculty can't commit to major changes before the academic year begins. Minor changes included reducing the stakes of the exam, allowing a formula sheet while maintaining difficulty of past years, and having the quals exam writers release a specific list of content required to be studied. Of the minor changes, students were most in favor of minor change #1, which was to have students that fail a qualifying exam question retake the class instead of having to retake the whole qual. This feedback suggests that a large part of the reason students are unhappy with the qualifying exams is the threat of being kicked out of the department based on a single, high-stakes exam.

Out of the 3 major changes proposed, all respondents were overall in favor of options 2 (placement test, 78% in favor) and 3 (research/literature assessment, 65% in favor). 90% of women (9 out of the 10 that responded) were in favor of option 3 (research/literature), varying from the general student body by a 25% discrepancy. This divergence indicates that women in the department largely prefer to be examined on research ability rather than coursework. Women were overall in favor of all 3 changes overall, while international students were in favor of option 2 by majority.

Next, we probed more precisely on how students would prefer to be examined if the current quals were eliminated and replaced with a research-oriented assessment. **Of the 3 research/literature proposals that were floated (based on other current quals formats in SEAS), in general, all of APAM was most positive about option 2 (research + literature) with 74% indicating that this would be a positive change.**

Our semi-quantitative analysis of general preferences between all changes (minor + major changes) showed that all students were most positive about the placement test ("Major Change #2", see section 7.4), followed by Minor Change #1 (if a student fails a question, they just have to retake the class instead of retaking the whole qual), followed by Major Change #3 (replacement of quals with a research/literature-focused exam). Positivity for this placement exam spanned across all APAM, including women and international students. Women were more positive about all three "major changes" than the rest of APAM (bottom three options in Figure 21), where they were most positive about the placement test and replacing the quals with a research / literature-focused assessment.

2 Introduction

In February 2020, PhD students in the Physics Department in GSAS, who had a similar qualifying exam to APAM's (multiple-day long course-focused examination followed by oral qualifying exam), formed a graduate student council (PGC, the Physics Graduate Student Council) and ran a survey to gauge student experiences surrounding the qualifying exam. PGC presented the GSAS Physics faculty with these findings in a faculty meeting. In this faculty meeting, the faculty voted to cancel the qualifying exam. An alternative examination

was decided in a later meeting. It was announced in November 2020, that the quals would be canceled for the new PhD students that had matriculated in 2020 (incoming class of 2020) and they would instead have to do a research report in the summer after their first year (Summer 2021), as a temporary quals format while the faculty decided on a permanent solution. Since then, the Physics faculty have officially implemented a new format: incoming students to the Physics Department in Fall 2022 and later will be required to take a placement test, where this will determine which classes first year students take and do not have to take (see Section 8.1: Quals in other STEM departments at Columbia). There is no qualifying exam.

In June 2022, the APAM graduate student council (AMPS) ran a similar survey among the Columbia APAM Ph.D. program student body in order to understand how students felt about the program's qualifying exams to inform potential ways to modernize these exams in our department's context. Currently, APAM's written qualifying exams (also referred to as "quals") are held once a year the week after finals in the Spring semester and taken by first year students (or second years who did not pass them the first time). The written quals consist of an 8 hour long exam, split over two days, where 8 subjects are tested, and all programs within APAM have unique questions, with the unifying topic being that all APAM PhD students must take an Applied Math question. If a student fails, they need to retake the written exam the following year. For the written exam, students are given previous qualifying exam questions (but no solutions) as study material. The oral exam is held the following year after passing the written exam, where the requirements of this exam depend on the APAM program of the PhD student. For this reason, feedback on the oral exam is split by program. There is no publicly known "score" required for passing either exam; professors meet to discuss the results. The pass rate of either exam is not publicly known, and could not be deduced from the survey due to students sometimes leaving the program if they fail written quals the first/second time. These exams have operated roughly the same way for decades.

In this report, you will find an evaluation of how students studied for their qualifying exams, how quals impacted their choice of Ph.D. program and considerations of leaving the program once enrolled, how effective they found quals to be, what impact quals had on students' mental health, as well as proposed changes that got student support in the survey. We also surveyed students on what they think is the purpose of the doctoral program in general, the purpose of quals, and their experiences with picking an advisor, which can be found in the appendix (Section 8.8). We also included a section with examples of how other programs in SEAS and other institutions of similar fields conduct their qualifying exams.

3 Demographics

The survey had a total of 58 respondents out of 80 total PhD students in the department, giving a participation of 72.5%. Figure 1 shows that at least 10 of each subfield participated (Applied Physics, Plasma, Materials Science, Applied Math). Of all respondents, 10 were women, 2 gender non-binary, 5 Hispanic/ Latinx, 5 from low-income backgrounds, 5 first-generation students, and 0 Black/African American. Note many of these responses overlap. This means that we don't have a good sample size (defined here as 10 or more) to evaluate

responses from historically excluded minorities without potentially identifying them. Since we don't know exactly how many students in the program are non-binary as our survey participation is only 72.5%, we estimate that a little more than 2/3 of male students and over 3/4 of female students in the program responded to the survey. 53.5% of respondents had taken written quals in the last two years (were either in their 1st or 2nd year of the PhD). There were two demographic groups with a large enough sample to be evaluated separately: women (10 responses) and international students (16 responses). Hence, some of the plots in this report also show separate analyses for these demographic groups, when they diverged from the response rate from the general student body.

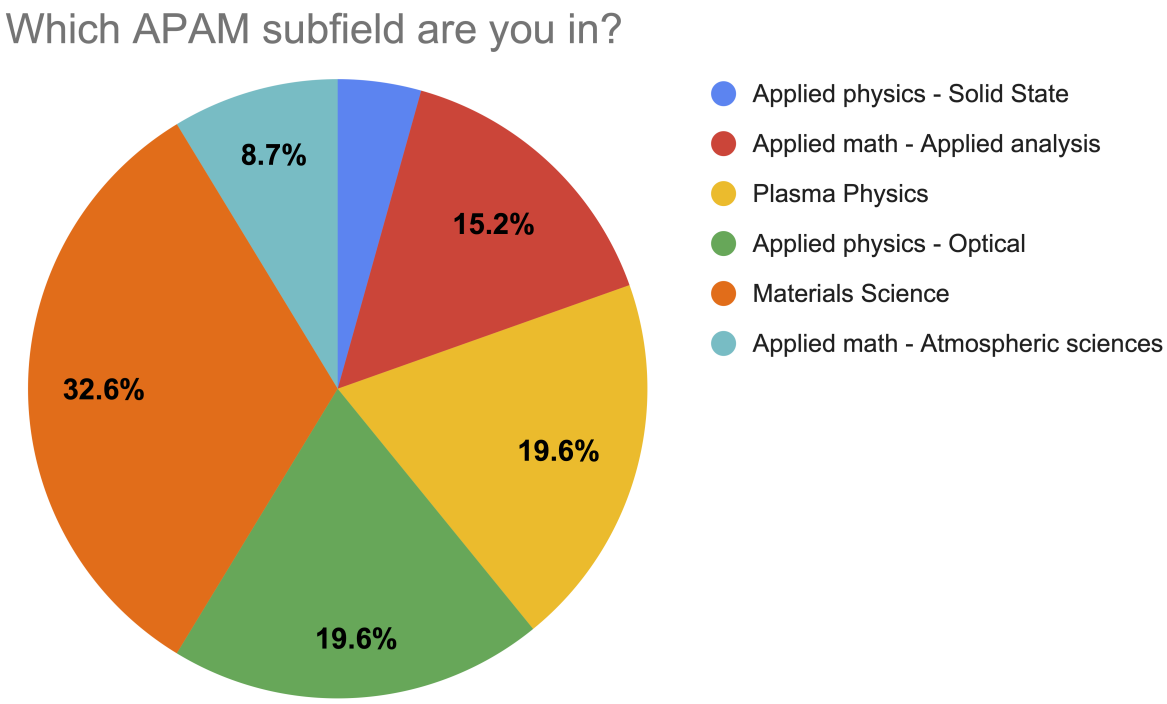


Figure 1: Subfields of survey respondents

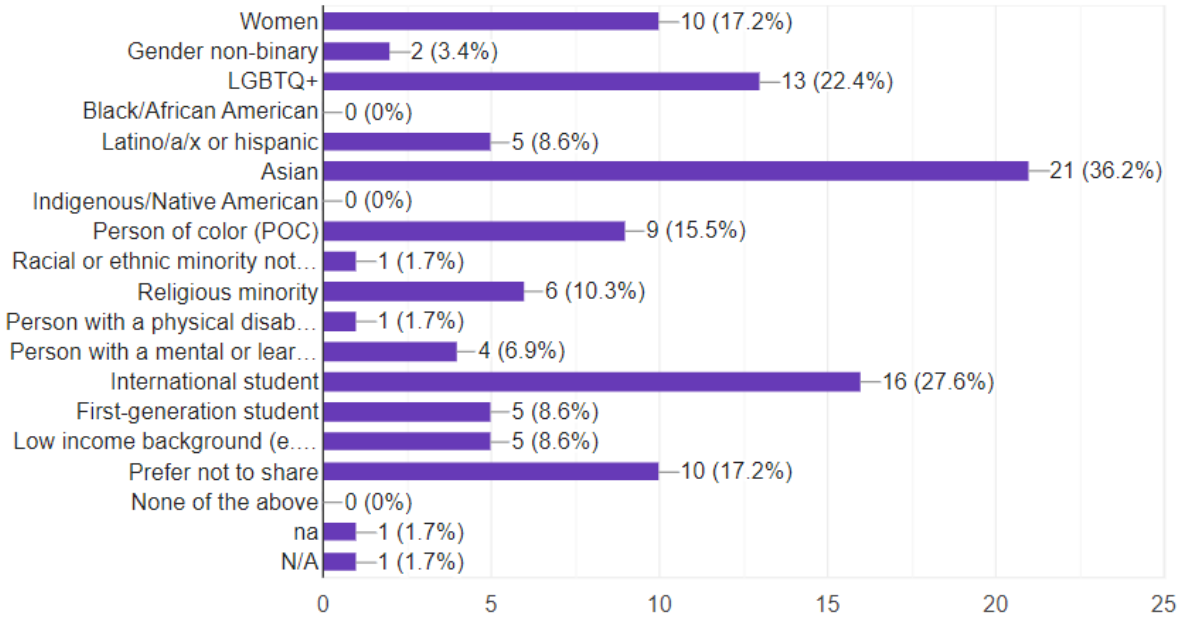


Figure 2: Demographics of survey respondents

4 Impact of Qualifying Exams on Program Choice and Program Retention Rate

Figure 3 shows that 13.8% of respondents in APAM hesitated to enter into the APAM doctoral program due to the quals, however, 40% of women respondents hesitated to accept the offer (Figure 3b). For international students 6.3% said that the quals had them hesitate to enter the program. In addition, 15% of all respondents indicated that they wished that they had given quals more thought when deciding between PhD programs.

25% of all respondents said that they had considered leaving the program and that quals were a factor in this (Figure 4a), while 40% of women respondents said that quals were a factor in considering leaving the program. These findings suggest that our quals, being more intensive than many other equivalent programs in the US (See Section 8.2, Quals in similar PhD programs in US), could play a part in repelling women from joining APAM and also play a role in retention of women/female experience in APAM. This effect may extrapolate out to other marginalized groups in STEM, though we do not have sufficient sample sizes on this.

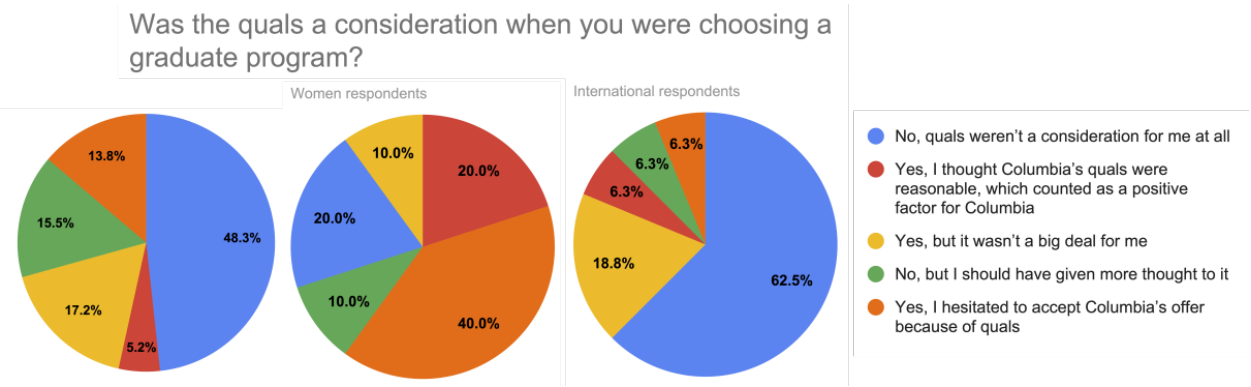


Figure 3: Asking if quals were a consideration when choosing APAM's program for (a) all APAM students and (b) women only (c) international students only.

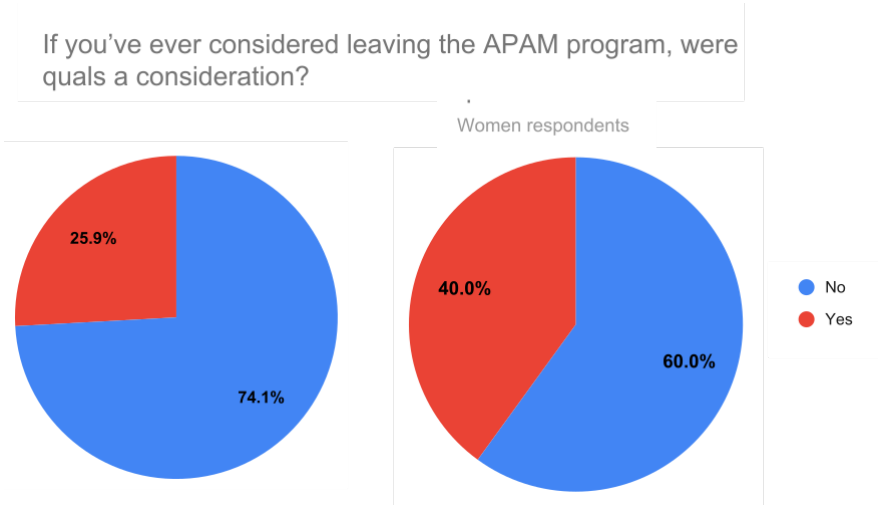


Figure 4: Asking if quals have ever been a factor in students leaving the program for (a) all APAM students (b) women

5 The Written Exam

5.1 How Students Prepared

Most students (60%) studied alone for most of the time (Figure 5). Figure 6 shows that students mostly prepared by reviewing past qualifying exam questions and coursework. Figure 7 shows the time spent studying for quals at various points during the semester. After spring break (8 weeks before quals) but before the week right before quals, 8.6% percent of students spent 60+ hours a week studying, 29.3% of students spent 20-60 hours studying for quals per week on average. In the week leading up to quals, this increased to 51.8%.

Concerningly, 37.9% spent 60+ hours studying, with 8.6% spending 100+ hours studying in the week leading up to quals (Figure 7). This result makes sense given that during the semester, students are quite busy with learning their current coursework (students must take 12 credits and have a 3.0 GPA), TAing, and finding an advisor. This data is reflective of

how students only have 1-2 weeks leading up to quals to study specifically for quals, because they are focused on these other commitments. Cramming content in this short time may not be conducive to long-term understanding of the material as well as ties into the poor mental health of the students during this time (See Section 8.4: Mental health quotes from studying for the written quals)

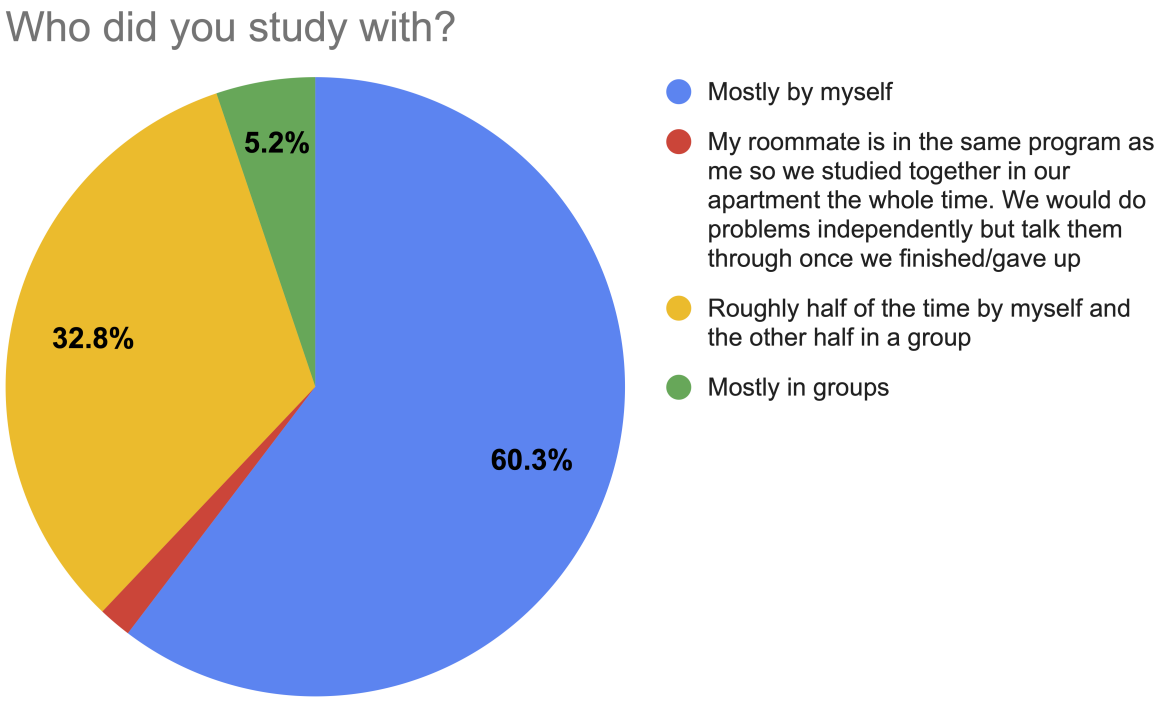


Figure 5: Who students study with

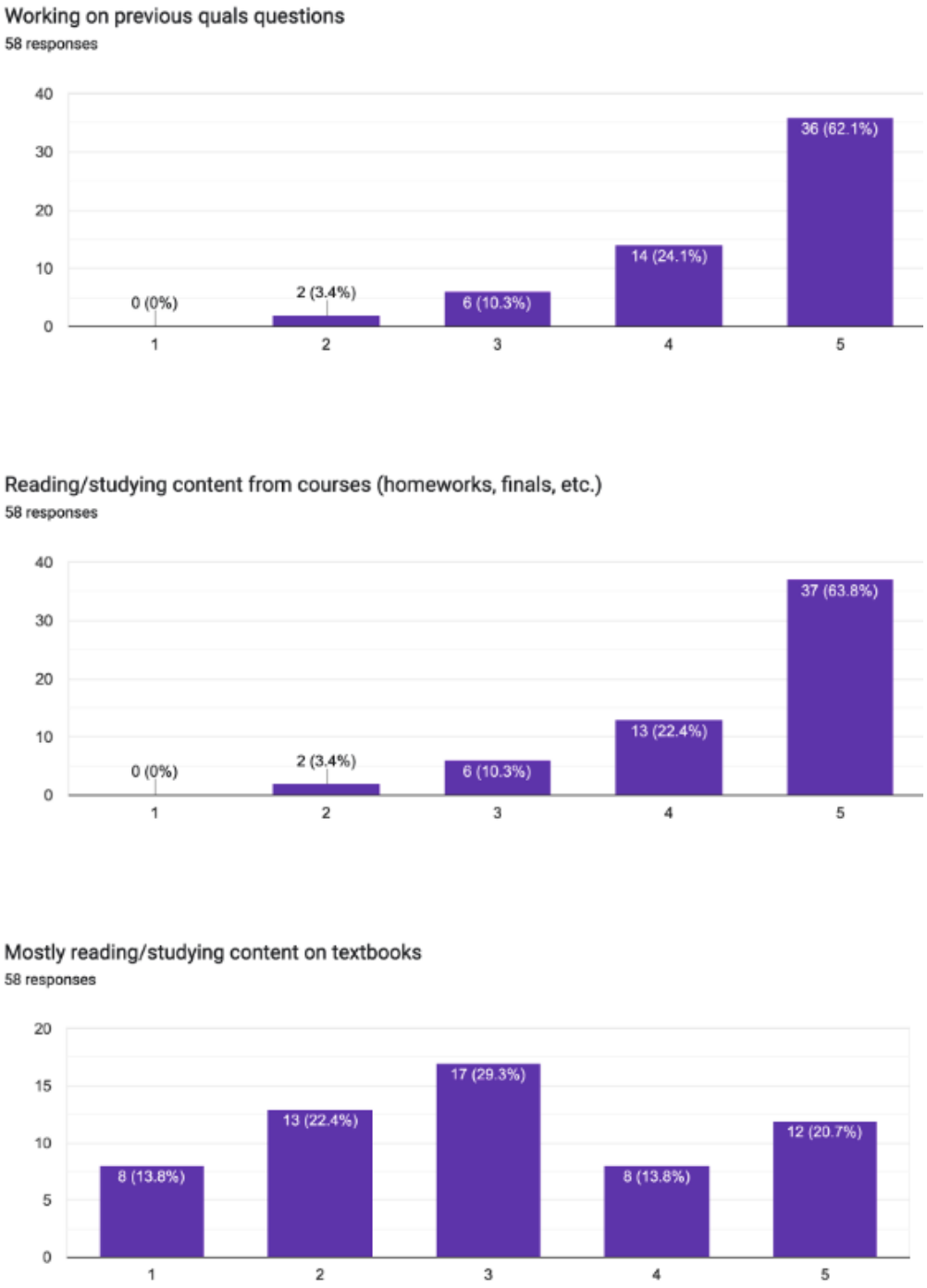


Figure 6: Students were asked to rate from 1-5 (1 least, 5 most) on what study materials they prioritized for studying for the written exam.

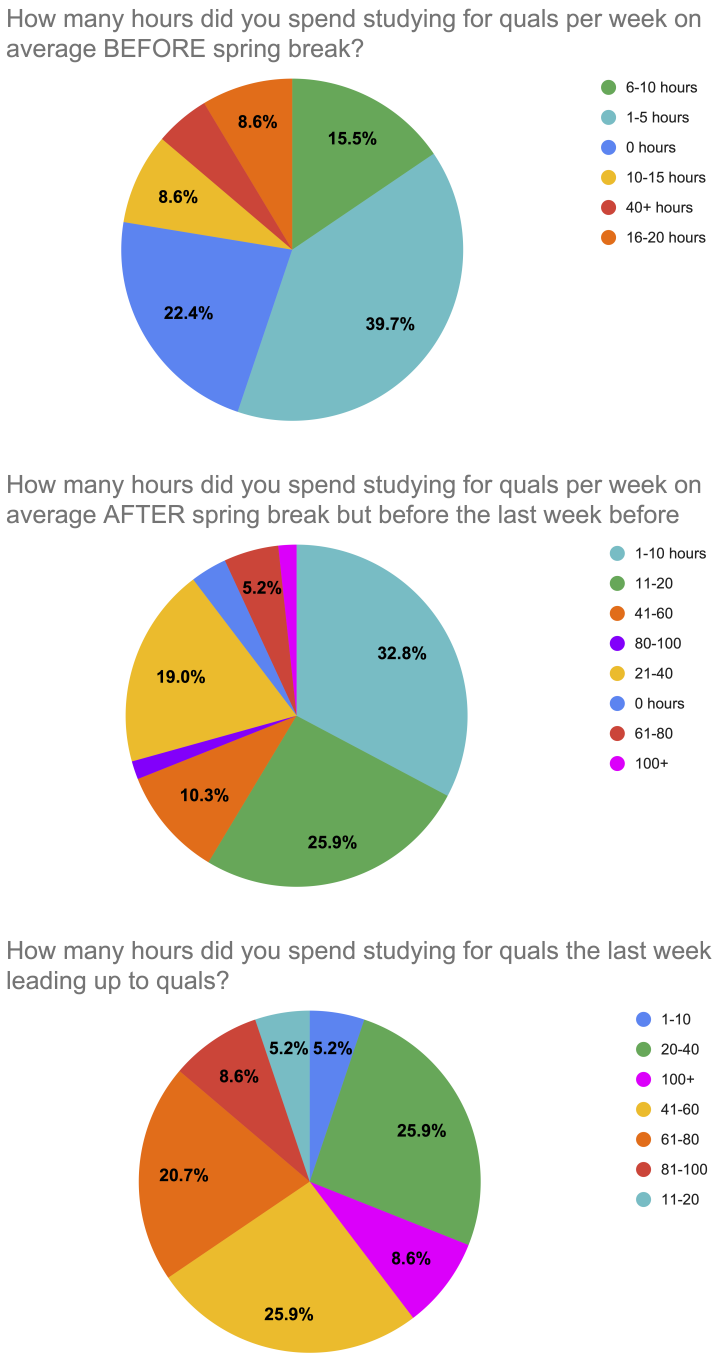


Figure 7: How much time students spent studying on average per week

5.2 Self studying for written quals questions and pertinence of questions on the quals exams

The following summarizes written responses to the survey which can be found in the appendix Section 8.6 Written responses: Did you self study any quals questions instead of taking the class? If so, why?
Section 8.7.1 Written responses: Do you have any general complaints about pertinence of topics/classes required for the exam (e.g. being required to take certain math courses if in Plasma/Materials Science, etc.).
Section 8.7.2 Written responses: Should some "qual questions" (topics/required courses) be replaced with topics from other courses? If so, which and why?

Students who self-studied topics instead of taking the associated APAM course largely did so because they had studied the topic during their undergraduate or masters and wanted to save time due to a heavy course load workload or a desire to spend more time on research. A few students chose to self-study qualifying exam topics so that they can take classes which they perceive as more relevant to their research. By far the most popular topic to self-study is Linear Algebra. Other topics which students self-studied are Statistical Mechanics, Quantum Mechanics, Phonons, Laser Physics, Physics of fluids, and Optics.

A common complaint among students is that certain qualifying exam topics have no relevance to their research, which also causes them to have less time to take courses on material related to their research. The most complained about topics are Classical Mechanics followed by Quantum Mechanics. Also mentioned are Statistical Mechanics and Phonons. A few students complained about excessive overlap between Intro to Numerical Methods and Numerical Methods for PDEs. With regard to the replacement of quals topics, a Plasma student wants Complex Analysis to be swapped in for it would have helped them better understand Kinetic Theory. Other topics students asked to be swapped in are Thermodynamics, atmospheric science topics and analysis topics.

Non-math students had split opinions on the importance of studying and being tested on math topics. They, however, were united in their concern about the math component of their quals being of equal weightage to the field-specific component of their quals. They were also concerned about having their grades for the math component of their quals be curved against math students doing those same questions.

5.3 Sentiments on if students want to change written quals / quals usefulness

In Figure 8, students were asked if APAM should keep the written quals as they are currently. Figure 8 shows that 34.5% of all respondents were in favor of keeping quals as is, while only 20% of women respondents agreed with this statement. 50% of international students were in agreement. 17.2% of all respondents were in favor of getting rid of written quals completely. Figure 9 shows that 41.5% of all respondents that have completed at least two full years in APAM do not think that quals prepared them for their PhD research, while another 36.6% say that they were somewhat prepared but felt there are more effective ways to prepare.

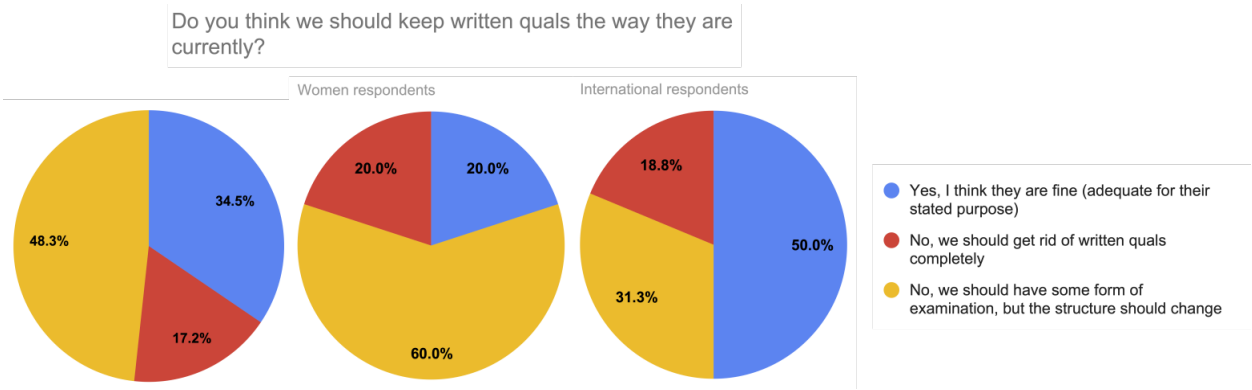


Figure 8: Responses on if students want to change quals (a) all APAM (b) women respondents (c) international students

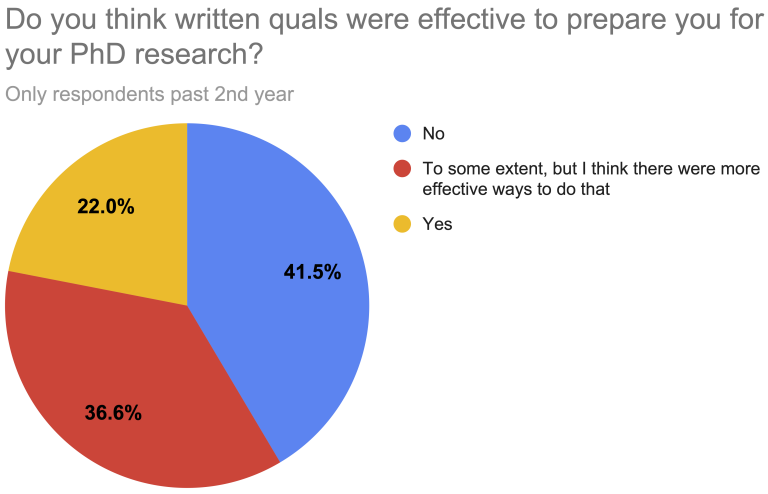


Figure 9: Students having completed at least two full years in APAM asked if quals were effective to prepare them for their doctoral research.

6 The Oral Exam

Note: only students that have taken the oral exam were allowed to provide feedback in this section

6.1 Summary of Oral Exam Sentiments across programs

Materials Science students were especially discontented with their oral exams, where 8 out of 14 respondents were in favor of changing the oral exam. The main divergence of the Materials Science exam format to other oral exams in APAM was found to be that the advisor does not pick the exam committee, which seems to negatively influence the student experience. Considering all respondents, many complaints (Section 8.5) cited irrelevance to their research and that they did not learn anything "new" that they hadn't already learned during written quals. Applied Math students were the only ones where research is the main focus of the oral exam, for which they were unanimously in favor of keeping oral quals as-is. Plasma physics has a mostly course-focused exam and also had students unanimously in favor of keeping oral quals as-is. Mental health quote responses by program are provided in the appendix, section 8.5, which show Materials Science students having more complaints than other programs in general.

6.2 Applied Physics (Solid State & Optical) Oral Exam Feedback

Oral exam overview:

The exam is course-focused (no research). Solid State and Optical PhD students are given a committee, most often picked by their advisor, but at least always including their advisor. Over the course of 1-2 hours, the committee members take turns asking questions of the student, who then discusses their approach to solving the problem. Of the 5 SS&O students who responded to the survey and had completed their oral exam, all highlighted the interactive nature of the exam; professors would help students if they got stuck, discussing the question or walking them through it, and asking follow up questions to probe the students' full understanding of the topic. Most stated they felt fine preparing for and taking the exam, with some stating they were stressed, or frustrated by taking the exam over Zoom.

Survey feedback:

Of the 5 relevant responses, most students spent fewer than 5 hours per week preparing for the exam, with one student devoting up to 40 hours in the final weeks before the exam. 3/5 think the oral exam is fine as it is, and the remaining 2/5 think it should be eliminated entirely. 2/5 of the students felt that the exam was effective for solidifying their understanding of the fundamentals of their field, and 3/5 felt that the exam was not effective in preparing them for their research.

6.3 Plasma Physics Oral Exam Feedback

Oral exam overview:

The exam is course focused, though some responded that research topics were also questioned. Plasma physics PhD students are given a committee of 3 professors. One of which is their advisor, and the other two are chosen by their advisor from among other plasma physics professors. However, the chair of the committee must be someone other than their advisor. The exam is typically somewhere between one to two hours long, and typically consists of questions on a single topic from each of the examiners that are split up into multiple smaller questions. More topics and questions can be covered if time permits. The questions tend to be on the topics covered in the first year courses, including topics that were covered in classes but not tested in the written qual, as well topics found in graduate level introductory textbooks. The questions also tend to be more qualitative than the written exam.

Survey feedback:

Only 6 Plasma respondents had taken oral quals. All respondents answered "Yes, they are fine for their stated purpose" to the question "Do you think we should keep oral quals the way they are currently?". Students that have completed 2 years+ only were asked: "Do you think oral quals were effective to prepare you for your PhD research?" All respondents responded positively, with one of them saying they felt so, but thought there were more effective ways to do that.

6.4 Applied Math Oral Exam Feedback

Oral exam overview:

The exam is research-focused. Applied Math PhD students are given a committee of 3 professors, including the advisor. The advisor is allowed to pick the committee and also ask questions during the exam. Applied Math students were instructed to prepare a 20-min presentation on research followed by about 75 minutes of questions from the committee, ranging from my basic knowledge about their research topic to their perspective on where the research might be heading. Some were instructed for the presentation to consist of theoretical material underlying their current research, with the understanding that they would be interrupted throughout to be asked questions. Questions ranged from simple understanding to being asked to work out examples to theoretical future research questions. Students are able to show their thought processes and have full discussions on research toward the end of the exam.

Survey feedback:

Only 6 Applied Math respondents had taken oral quals. All of these respondents answered "Yes, they are fine for their stated purpose" to the question "Do you think we should keep oral quals the way they are currently?". Students that have completed 2 years+ only were asked: "Do you think oral quals were effective to prepare you for your PhD research?" All respondents responded yes.

6.5 Materials Science Oral Exam Feedback

Oral exam overview:

The exam is course-focused. Materials science PhD students are given a committee of 3 professors, typically at least 2 out of the 3 professors wrote questions on the written exam and thus it does not represent the thesis committee. Their advisor is allowed to observe but not allowed to ask questions or participate in the discussion after the exam about if the student should pass. It is an hour-long oral exam where students are asked several questions about concepts from the classes that were tested on the written exam. The questions are typically more qualitative than the written exam.

Survey feedback:

14 of 16 materials science survey respondents had taken oral quals, and thus were asked questions about their sentiments. Figure 10 shows that 8 out of 14 respondents of Materials Students think that oral quals should be changed. Figure 11 shows that 8 out of 14 of students that have completed at least two years in materials science believe that oral quals did not prepare them for doctoral research, while 3 out of 14 respondents said that they felt somewhat more prepared for doctoral research, but that they believe there are better ways to prepare students for this via quals structures. Mental health responses about this exam were generally negative compared to other programs, with one student reporting being "denounced" by faculty during the exam (Section 8.5.4). Two materials science students complained that their examiners were unfamiliar with their research work and one student was unhappy about memorization, indicating discontent about the exam being on similar content as the written exam.

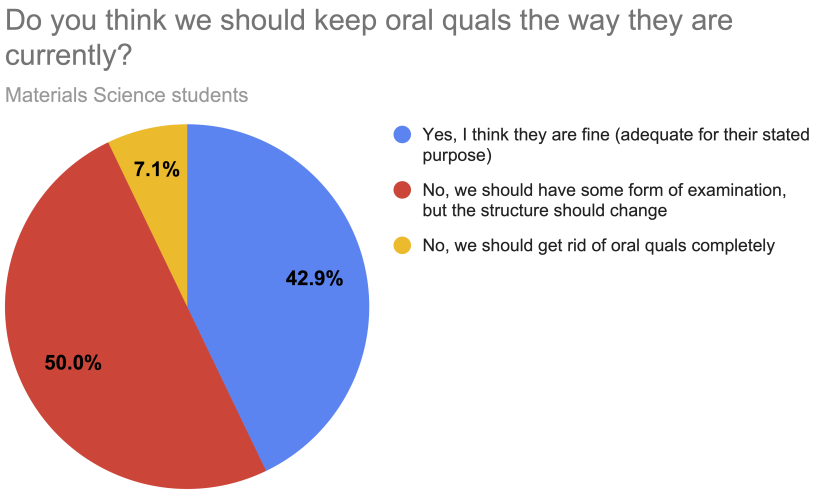


Figure 10: Materials Science students asked if they think oral quals should be reformed

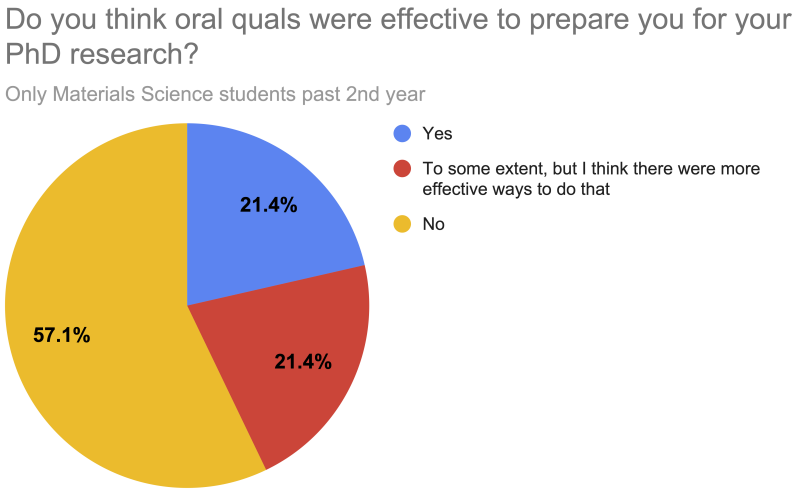


Figure 11: Materials Science students that have completed at least 2 full years in APAM asked if oral quals were effective to prepare them for their research.

7 Proposed changes to exam structure

Contents

7.1 Summary of survey findings about proposed changes

First, we will list all proposed changes that the respondents voted on in this section:

Minor changes to quals:

1. If a student fails a written quals question, the student retakes the course instead of having to retake the entire written qualifying exam. There is no threat of being kicked out by the department as long as the student retakes the course and passes.

2. For written quals, students are allowed a standardized formula sheet made by the exam writers and the exam taking time is extended by two hours on each day (and the difficulty of questions are to be maintained the same as previous years).

3. Explicit, clearly communicated list of relevant content for each qual question provided at least a month before the written exam (e.g. a list of textbook chapters relevant to the question)

Major changes to quals:

1. Eliminate written quals and keep a course-based oral exam only (which is how it currently is for all programs except applied math).

2. Eliminate written/oral quals. Instead administer an optional placement test upon arrival and implement a uniform GPA requirement for PhD students in the core classes that were tested on the former written quals. Students that pass placement test questions can skip that course and take a department approved elective instead. (Optional placement test because some students come in with no background in their program and need to take all classes).

3. Eliminate written/oral quals and replace with research or literature focused quals

Proposals for research/literature-focused quals:

1. (Research only proposal) At the end of the second semester the 2nd year, the qualifying exam is a 10-15 min presentation of the student's research project and the examiners ask questions about their project as it relates to fundamentals of their program. There is also a written research report for all APAM students

2. (Research + literature review) At the end of summer after first year, the student will first present their research project idea and progress in 5 minutes. The student will also have to read 3 academic papers related to the student's field of research provided by the faculty committee members at least two weeks in advance (each member will provide one paper). The examiners will ask questions about the papers and how they relate to the proposed research to gauge that the student has fundamental understanding of their field and the challenges in their project

3. (Literature review only) At the end of summer after first year, the student will submit a 6-8 page summary, critical analysis, and literature review of their chosen research problem/topic of interest. There will then be a presentation and oral exam of the content of this report to gauge the student's understanding of the fundamentals of their field and the challenges specific to their chosen topic

A majority of respondents are in favor of all minor changes to the current exams that were proposed, indicating that minor changes in the next academic year would greatly improve morale amongst PhDs as the faculty decide on more major changes for the following year. Of the minor changes, students were most in favor of minor change #1: retake the course if the qual question is failed. This feedback suggests that a large part of the reason students are unhappy with the qualifying exams is the threat of being kicked out of the department based on a single exam.

Out of the 3 major changes, the majority of respondents were in favor of options 2 (placement test, 78% in favor) and 3 (research/literature assessment, 65% in favor). 90% of women (9 out of the 10 that responded) were in favor of option 3 (research/literature), indicating that women in the department largely prefer to be examined on research ability rather than coursework. The majority of women are in favor of all 3 changes, while international students were only in favor of option 2 by majority.

Next, we probed more precisely on how students would prefer to be examined if the current quals were eliminated and replaced with a research-oriented assessment. **Of the 3 research/literature proposals that were floated based on other quals formats in SEAS, in general all of APAM was most positive about option 2 (research + literature) with 74% indicating that this would be a positive change**. For option 1 (research only qual), 71% said this structure would be a positive change. For option 3 (literature only), 69% said this would be a positive change. Women were most in favor of option 1 (research only, 80% approval by women) while international students were most in favor of option 2 (research + literature, 62.5% by international students).

Our semi-quantitative analysis of all changes (minor + major changes) showed that all students were most positive about the placement test ("Major Change #2", see section 7.4), followed by Minor Change #1 (if a student fails a question, they just have to retake the class instead of retaking the whole qual), followed

by Major Change #3 (replacement of quals with a research/literature-focused exam). Positivity for this placement exam spanned across all APAM, including women and international students. Women were more positive about all three "major changes" than the rest of APAM (bottom three options in Figure 21), where they were most positive about the placement test and replacing the quals with a research / literature-focused assessment.

7.2 Explanation of how data was collected

Students were asked to evaluate both minor and major changes to quals, where each change is considered independently. Students were instructed to "rank" these changes on a 1-10 scale:

10: This is an ideal reform to me (Most positive)
5: I agree this is an improvement to the status quo, but it's not ideal to me (Positive)
3: I believe this won't significantly change the quals experience (Neutral)
1: I think this would make it worse (Negative)

To first get a binary look at if students were generally in favor of a reform or not, we first agglomerate the positive regime (4-10), negative regime (1-2) and neutral (3) to make pie charts. For pie charts, we agglomerated responses of 4-10 meaning: this is a positive reform, 3: neutral, and 1-2: this would make quals worse. The ranking system was used semi-quantitatively to average the responses to see which reforms get the most positive feedback on average. (If one response has a higher average "rank" than others, it is clearly more favored by students in general). Thus, for each proposal, we provide a pie chart and an average "rank" from respondents. All rankings are compiled for semi-quantitative analysis in Section 7.6.

7.3 Minor changes to current exams

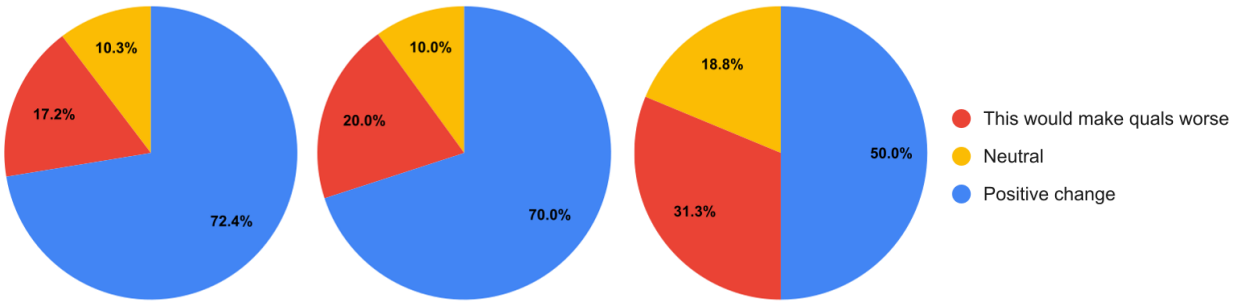
Respondents exhibited a majority in favor of minor changes that were proposed, which were:

1. If a student fails a written quals question, the student retakes the course instead of having to retake the entire written qualifying exam. There is no threat of being kicked out by the department as long as the student retakes the course and passes.

2. For written quals, students are allowed a standardized formula sheet made by the exam writers and the exam taking time is extended by two hours each day (and the difficulty of questions are to be maintained the same as previous years).

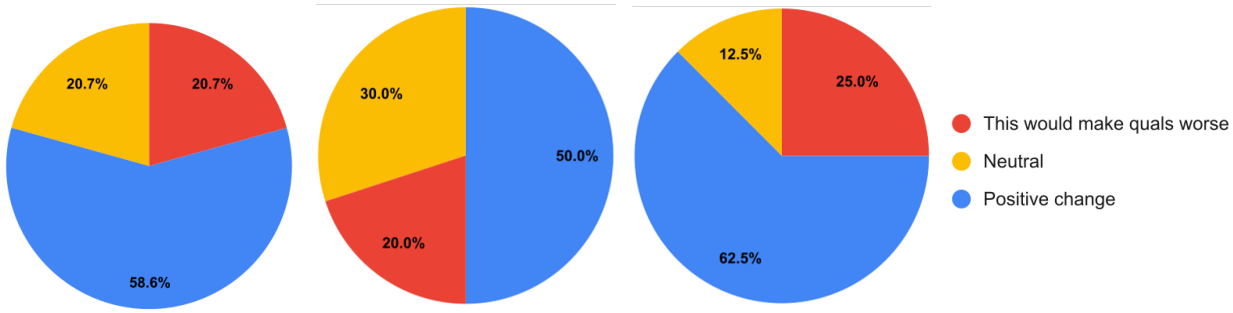
3. Explicit, clearly communicated list of relevant content for each qual question provided at least a month before the written exam (e.g. a list of textbook chapters relevant to the question)

72% of all respondents were in favor of change #1, 59% in favor of change #2, and 72% in favor of change #3 (Figure 15, 16, and 17, respectively). This feedback suggests that a large part of the reason students are unhappy with the qualifying exams is the threat of being kicked out of the department based on a single exam.



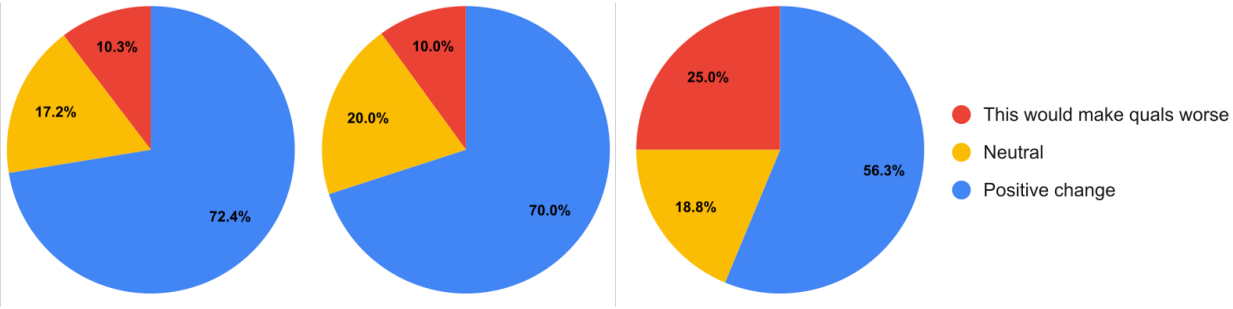
(a) All APAM students (b) Women (c) International

Figure 12: Responses for minor change #1 (If a student fails a written quals question, the student retakes the course instead of having to retake the entire written qualifying exam. There is no threat of being kicked out by the department as long as the student retakes (or takes for the first time if they hadn't yet) the course and passes) for all APAM students, yielding average rank of 5.7 and (b) women, yielding an average rank of 5.8 (c) international students, yielding an average rank of 4.3



(a) All APAM students (b) Women (c) International

Figure 13: Responses for minor change #2 (For written quals, students are allowed a standardized formula sheet made by the exam writers and the exam taking time is extended by two hours on each day (and the difficulty of questions are to be maintained the same as previous years)) for all APAM students, yielding average rank of 5.1 and (b) women, yielding an average rank of 4.2 (c) international students, yielding an average rank of 5.4



(a) All APAM students (b) Women (c) International

Figure 14: Responses for minor change #3 (Explicit, clearly communicated list of relevant content for each qual question provided at least a month before the written exam (e.g. a list of textbook chapters relevant to the question)) for all APAM students, yielding average rank of 4.2 and (b) women, yielding an average rank of 4.4 (c) international students, yielding an average rank of 5.1

7.4 Major changes to current exams

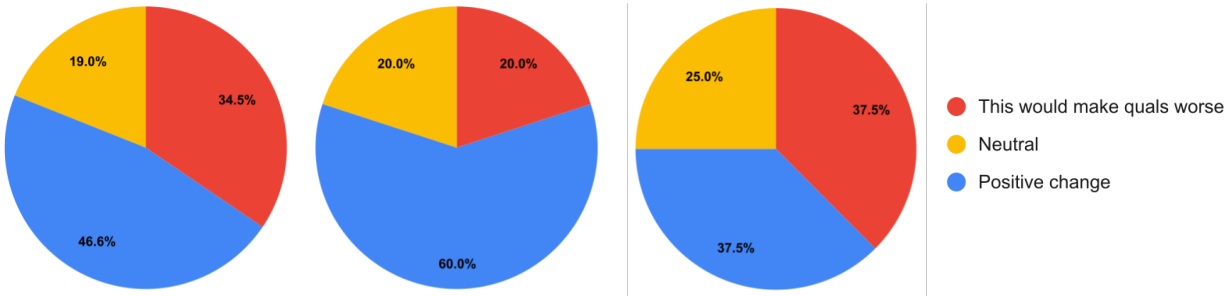
Students were presented with the following "major" changes:

1. Eliminate written quals and keep a course-based oral exam only (which is how it currently is for all programs except applied math). (Figure 15)

2. Eliminate written/oral quals. Instead administer an optional placement test upon arrival and implement a uniform GPA requirement for PhD students in the core classes that were tested on the former written quals. Students that pass placement test questions can skip that course and take a department approved elective instead. (Optional placement test because some students come in with no background in their program and need to take all classes). (Figure 16)

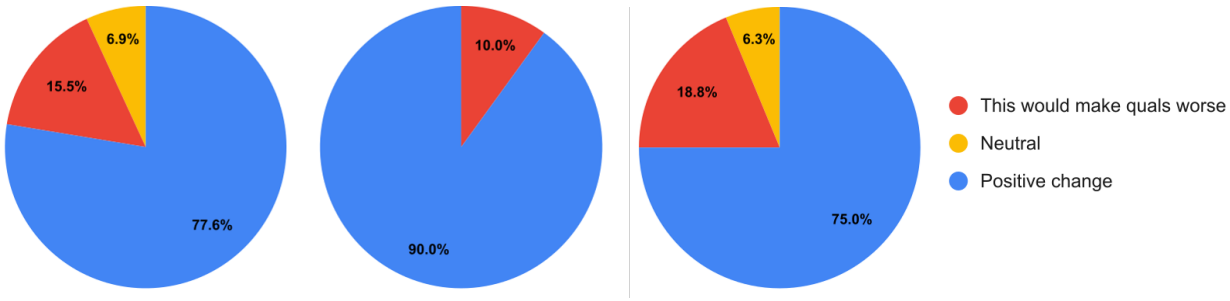
3. Responses for eliminating quals and replacing with research or literature focused quals (Figure 17)

Out of the 3 major changes proposed, all respondents were overall in favor of options 2 (placement test, 78% in favor) and 3 (research/literature assessment, 65% in favor). 90% of women (9 out of the 10 that responded) were in favor of option 3 (research/literature), varying from the general student body by a 25% discrepancy. This divergence indicates that women in the department in general prefer to be examined on research ability rather than coursework. Women were overall in favor of all 3 changes overall, while international students were in favor of option 2 by majority.



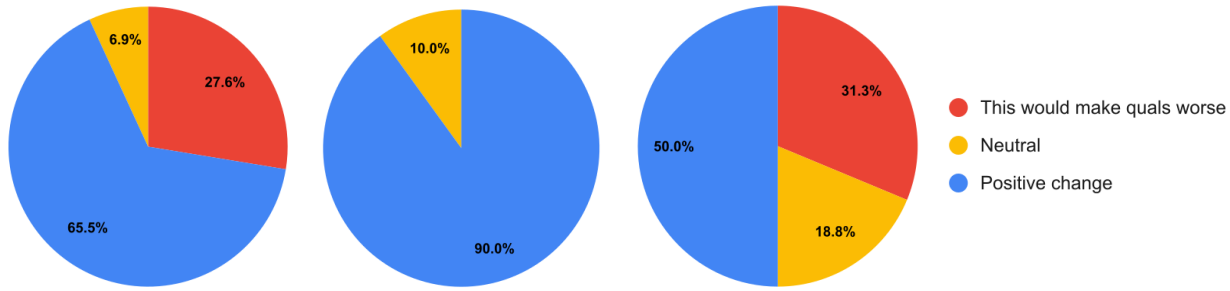
(a) All APAM students (b) Women (c) International

Figure 15: Responses for major change #1 eliminate written quals and keep a course-based oral exam only (which is how the oral exam currently is for all programs except applied math). (a) all APAM students, yielding average rank of 4.2 and (b) women, yielding an average rank of 4.7 (c) international students, yielding an average rank of 4.7.



(a) All APAM students (b) Women (c) International

Figure 16: Responses for major change #2: eliminate written/oral quals. Instead administer an optional placement test upon arrival and implement a uniform GPA requirement for PhD students in the core classes that were tested on the former written quals. Students that pass placement test questions can skip that course and take a department approved elective instead. (Optional placement test because some students come in with no background in their program and need to take all classes). (a) all APAM students, yielding average rank of 6.40 and (b) women, yielding an average rank of 7.2 (c) international students, yielding an average rank of 6.6



(a) All APAM students (b) Women (c) International

Figure 17: Responses for major change #3 eliminating quals and replacing with research or literature focused quals for (a) all APAM students, yielding average rank of 5.5 and (b) women, yielding an average rank of 6.3 (c) international students, yielding an average rank 4.9

7.5 Major changes to current exams: specific proposals

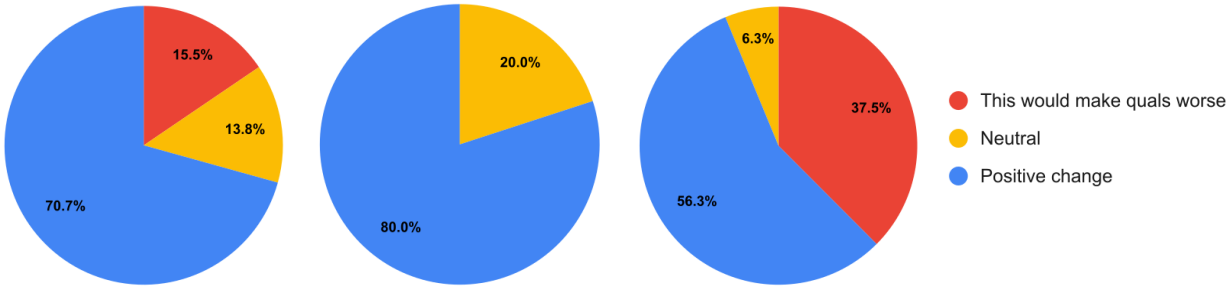
In a new section, students were asked to assume that the current quals (written and oral) were eliminated and replaced with research or literature-focused structures as shown. Each option is independent of the other. Research/Literature Focused Exams Proposals:

1. (Research only proposal, Figure 18) At the end of the second semester the 2nd year, the qualifying exam is a 10-15 min presentation of the student's research project and the examiners ask questions about their project as it relates to fundamentals of their program. There is also a written research report for all APAM students (Note: similar to Chemical Engineering and Department of Earth and Environmental Sciences (DEES) Quals)

2. (Research + literature review, Figure 19) At the end of summer after first year, the student will first present their research project idea and progress in 5 minutes. The student will also have to read 3 academic papers related to the student's field of research provided by the faculty committee members at least two weeks in advance (each member will provide one paper). The examiners will ask questions about the papers and how they relate to the proposed research to gauge that the student has fundamental understanding of their field and the challenges in their project (Note: similar to Earth & Environmental Engineering in SEAS Quals)

3. (Literature review only, Figure 20) At the end of summer after first year, the student will submit a 6-8 page summary, critical analysis, and literature review of their chosen research problem/topic of interest. There will then be a presentation and oral exam of the content of this report to gauge the student's understanding of the fundamentals of their field and the challenges specific to their chosen topic (note: similar to BME/computer science in SEAS qualifying exams)

Of the 3 proposals, in general all of APAM was most positive about option 2 (research + literature) with 74% indicating that this would be a positive change. For option 1, 71% said this (research only qual) would be a positive change. For option 3 (literature only), 69% said this would be a positive change. Women were most in favor of option 1 (research only, 80% approval by women) while international students were most in favor of option 2 (research + literature, 62.5% by international students).

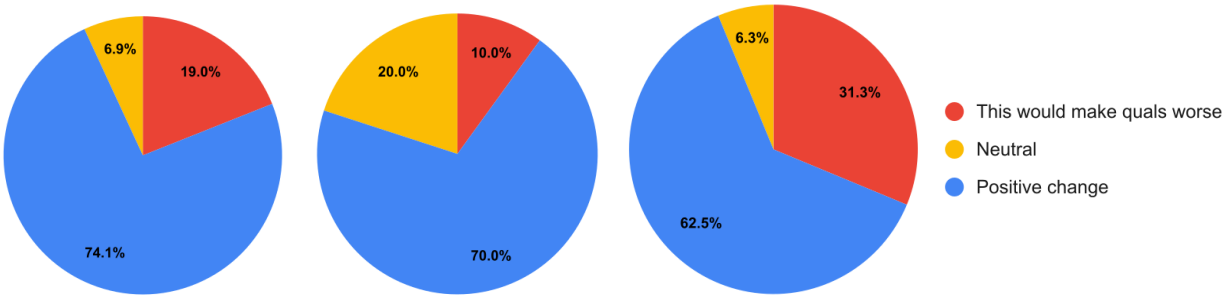


(a) All APAM students (b) Women (c) International

Figure 18: Responses for research only proposal for all APAM students, yielding average rank of 6.3 and (b) women, yielding an average rank of 7.2 (c) international students, yielding an average rank 5.2

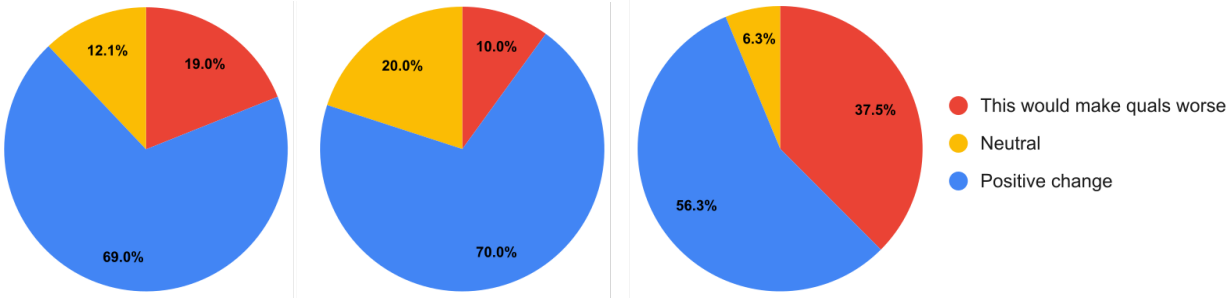
7.6 Semi-quantitative analysis of minor and major changes

Figure 21 and Figure 22 plot the average "rank" of proposals mentioned thus far. Of all minor changes (first 3 options in Figure 21), students were most positive about minor change #1 (retake the class if you failed a question instead of retaking the entire exam). However, of all changes (minor and major changes), all students were most positive about the placement test only ("major change #2"), with an average ranking of 6.4. This positivity for this placement exam spanned across all APAM, including women and international students.



(a) All APAM students (b) Women (c) International

Figure 19: Responses for research + literature review proposal for (a) all APAM students, yielding average rank of 6.1 and (b) women, yielding an average rank of 6.7 (c) international students, yielding an average rank 5.3



(a) All APAM students (b) Women (c) International

Figure 20: Responses for literature review only proposal for (a) all APAM students, yielding average rank of 5.6 and (b) women, yielding an average rank of 5.8 (c) international students, yielding an average rank 5.1

Women were more positive about major structural changes than the rest of APAM for all three "major changes" (bottom three options in Figure 21), where they were most positive about the placement test and replacing the quals with a research/literature assessment.

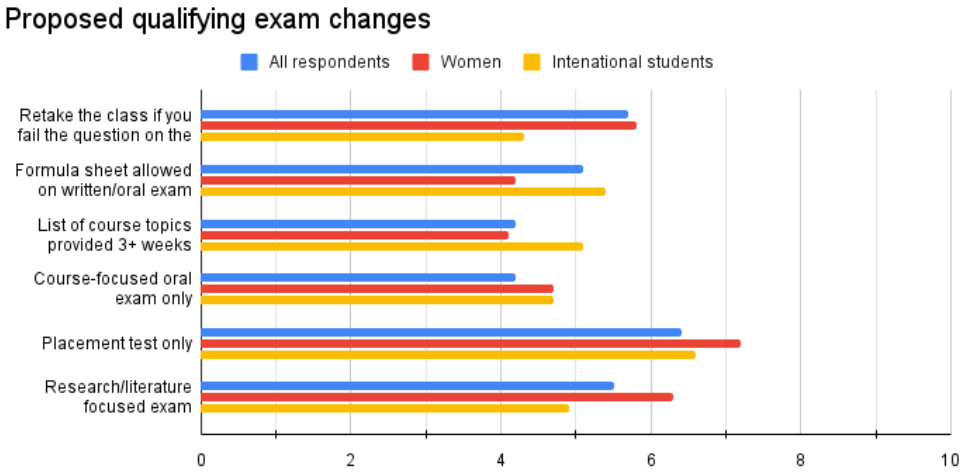


Figure 21: Respondents rank different quals changes, including minor specific changes and major general changes. The number plotted is the average of all responses for the specified group.

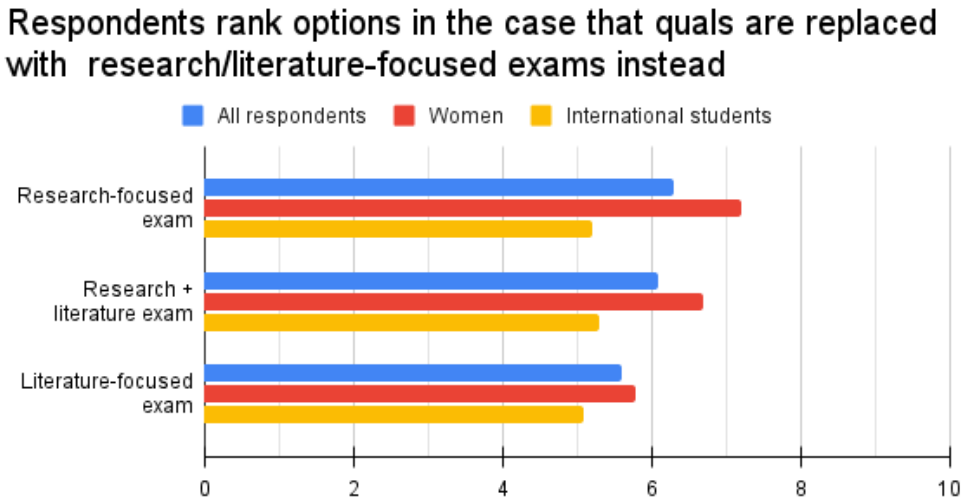


Figure 22: Follow up to Figure 21: Respondents rank specific major quals changes assuming that quals are to be replaced with research/literature-focused exams instead. Respondents were told to assume APAM's current written/oral quals were being replaced with a research or literature focused exam and to rank these choices. The number plotted is the average of all responses for the specified group.

8 Appendix

Contents

8.1 Quals in other STEM departments at Columbia

These summaries of qual structures were pasted from summaries on the respective department's website (this information is publicly available).

8.1.1 BME qualifying exam (literature review only)

1. Written component (6-8 pages): summary, critical analysis, and syntheses of three papers from literature, and description of the state of the art in the chosen research problem/topic of interest.

2. Oral presentation (between 30 and 45 minutes): summary, critical analysis and synthesis of three papers within the context of a chosen research problem. Committee may ask questions at the beginning of the presentation.

3. General examination (approx. 60 minutes) in which the candidate answers questions posed by the examination committee.

8.1.2 Earth and Environmental Engineering Qualifying Exam (literature + research)

1. At the exam, students should give a 5-minute presentation on their research interest, defining a broad problem area, and dedicated to a broad audience. This is followed by 50 minutes of questions and answers by the exam committee composed of three members of the EEE department, who represent three areas of the department. The questions will assess the research capacity of the student in addition to their common core courseworks (e.g. thermodynamics in the energy track).

2. The primary objective is to assess the capacity to think through those questions, which are meant to be very generic but to demonstrate the capacity to use basic knowledge in the field of research of the candidate. Sample questions and guidelines will be circulated before the exam. The candidate will be assessed on his/her fundamental knowledge of the topics and also clarity of presentation.

3. The qualifying exam will be based on 3 research papers that will be provided by the faculty committee members one week in advance (each member will provide one paper). Those papers are meant to assess the understanding of the students on classes he/she has covered earlier. This list of classes taken by the student will be made available to the committee before they have to select a class. The test will last for one hour and will be an oral examination. The student will first present his/her research (one to two slides) and then one slide presenting the list of classes taken, followed by questions on the papers.

8.1.3 Computer science qualifying exam (literature only)

The committee, after consideration of the student's input, selects a syllabus of the 20-30 most significant documents that encompass the state of the art in the area. The student then studies this syllabus. The oral exam begins with the student's 30 minute critical evaluation of the syllabus materials, and is followed by no more than 90 minutes of questioning by the committee on any subject matter related to their contents. The student is judged primarily on the oral evidence, but the content and style of the presentation can account for part of the decision. The entire candidacy exam committee must be informed of the scheduling of the oral exam no later than two weeks (14 days) prior to the exam. The Doctoral Program Administrator must be informed of the scheduling of the oral exam no later than two weeks (14 days) prior to the exam. Emergency exceptions to either of these deadlines can be granted by the Director of Graduate Studies or the Department Chair on appeal by the advisor and agreement of the committee.

8.1.4 Chemical Engineering Qualifying Exam (research only)

The student must pass the qualifying examination, given at the beginning of the 2nd year. The qualifying examination consists of a written report, and a 15-minute oral presentation. The oral presentation will be delivered on the first Friday of the Fall semester of the 2nd year. Each student's presentation will be followed by a 15-minute question-and-answer period by the exam committee on preliminary results and chemical engineering principles. Students should submit the written report one week before the oral presentation. This report should be 10 pages long (not including cover page or cited references), and it should summarize literature search and provide preliminary results and analysis. The exam committee will be composed of all faculty members (plus co-advisors if they are from other departments). All students must petition the graduate committee by the last day of the previous Spring semester to take the qualifying exam. A petition form is attached. Permission is generally granted if the student has accomplished a GPA of 3.2 or greater in graduate coursework. In preparation for the qualifying exam, the student's advisor should have the opportunity to provide general comments on the overall contents and research directions of the written

report, but should not re-write the report for students., In addition, the advisor should not participate in the practice talks; students should be able to independently prepare a 15-minute presentation based on the written report. Students who pass the Qualifying Examination are considered to be in good standing. Students who fail are normally asked promptly to complete the M.S. degree and are not permitted to continue in the doctoral track. Based on performance on the initial attempt, a student may be given a conditional pass. Such a student will be given one more chance at the end of the same Fall semester to the thesis committee of three faculty members. Failure to pass on the second attempt will result in dismissal from the doctoral track.

8.1.5 IEOR (research only)

The qualifying procedure consists of three components, including: (1) complete the four core courses during the first year, with an average grade of A- or above; (2) conduct research during the first summer (ideally starting in Spring or earlier) and present it in a department seminar at the beginning of the third semester; and (3) submit a research report (paper) at the end of the third semester. Students will be reviewed after each component. Students will be reviewed after each component. A student who fails to complete component (1) may be asked to withdraw from the program at the end of the first year. A student who successfully completes component (1) will typically move on to do summer research, advised by a faculty member in the IEOR department. In the rare instance that the PhD Committee is dissatisfied with a student's performance in components (2) and (3), they may be asked to withdraw from the program at the end of the second year.

8.1.6 Civil Engineering (research only)

At the end of the second year, doctoral candidates will take the qualifying exam, which will consist of a written research proposal and an oral research presentation to a committee of three faculty members. At least two of the committee members must be from the Civil Engineering and Engineering Mechanics department. Further information about the format will be provided by the Graduate Admissions and Student Affairs Officer.

8.1.7 Physics Department Qualifying Exam (after the 2020 reform, not actually a "qualifying exam", it is just a placement test now)

A written placement exam will be administered in the orientation week before the start of classes in the Fall semester. The purpose of the Placement Exam is to ensure the success of all students admitted to our Ph.D. program by providing individualized guidance on courses for optimal development. Our experience is that the admissions process successfully identifies students with the appropriate ability, but does not guarantee uniformity in preparation of the talented individuals admitted to our program. The exam will consist of problems typical of those found in our introductory and advanced undergraduate courses in mechanics, electromagnetism, quantum mechanics and statistical mechanics. The exam will have two parts, each 3 hours in length. Part I will cover mechanics and electromagnetism; Part II will cover quantum mechanics and statistical mechanics. If the examination identifies for any student a gap in preparation at a level that would prevent successful completion of one or

more of the required graduate courses, that student will be required to successfully complete the corresponding undergraduate course(s) before taking the graduate course on that topic. Students are expected to obtain a grade of B+ or better on the undergraduate course. All students are required to take the placement exam.

Details

The exam will consist of two 3-hour session in orientation week. The first exam will cover classical mechanics and electromagnetism, while the second will cover quantum mechanics, and statistical Mechanics and thermodynamics. Students will be informed of the results of the Placement Exam in the first week of classes by the Physics Director of Graduate Studies. The level of the material covered by the Placement Exam and the mapping onto our undergraduate courses are as follows:

- Mechanics, Physics GU4003: Classical Mechanics, Goldstein, Poole and Safko.
- Electromagnetism, Physics GU3007-3008: Introduction to Electrodynamics, Griffiths.
- Quantum Mechanics, Physics GU4021-4022: Introduction to Quantum Mechanics, Griffiths; A Modern Approach to Quantum Mechanics, Townsend.
- Statistical Mechanics, Physics GU4023: An Introduction to Thermal Physics, Schroeder; Thermal Physics, Kittel and Kroemer.

Please note that this guidance is intended to be descriptive, not proscriptive. There are many other excellent textbooks for each of these subjects

8.1.8 Department of Earth and Environmental Sciences (DEES, most relevant to our atmospheric science PhD students as many work in these labs) – research only, reformed 2020.

The Qualifying Exam consists of a written Qualifying Paper and an oral examination of the Qualifying Paper. The student will be evaluated on their ability and preparedness to conduct Ph.D. level research and demonstrate commensurate academic knowledge of his/her specialties. The Qualifying Paper should present the student's research and findings. While the paper may focus on one specific aspect of the Earth, the General Introduction must convey an understanding of the interconnectedness inherent in the Earth and Environmental Sciences. The student must demonstrate a comprehensive understanding of the questions being addressed by showing they have a broad knowledge of how their specialization connects to other aspects of Earth Science.

Mechanical Engineering, Mathematics, and Electrical Engineering have very similar quals to us with a written component on coursework and some also have supplemental course-based orals like APAM

8.2 Quals in similar PhD programs in US

8.2.1 Physics

Cornell Applied and Engineering Physics (GPA requirement + oral exam) [1]

Cornell AEP has designed their qualifying process before students begin research to ensure students "demonstrate a competency in a common core of physics subjects." To accomplish this, they require students to complete 4 courses covering quantum mechanics, electrodynamics, statistical mechanics, and advanced laboratory techniques and obtain a B- or better in all. For each of the former 3 subjects, there are at least 2 courses that will fulfill the requirement, some of which are offered by other departments. Students are also permitted to place out of these courses by taking the final exam for the AEP courses at the regular exam time in lieu of taking the full class. For these place-out exams, they must obtain the equivalent of a B- or better, or they will have to take the course and will not be eligible to take any future place-out exams.

Following completion of these coursework requirements, the student will take an oral exam to ensure they are prepared for research and are competent in another minor area of study outside of physics that they have chosen. It is administered by their committee in their 2nd or 3rd year in the program.

Harvard Applied Physics (GPA requirement + oral exam) [2]

Harvard requires students create a program plan of coursework that will build their knowledge of their discipline and complementary topics related to their research area. This program plan will consist of at least 16 courses, with various requirements ensuring that the courses are adequately advanced and focused in the students discipline, while also allowing flexibility to take related courses which will help them become a well-rounded researcher. The student must obtain a B- or better in all courses and maintain a minimum B GPA overall.
By the end of their second year, the student will take an oral exam administered by a committee composed of their advisor and 3 other faculty chosen by the student, their advisor, and the department. The stated purpose of the exam is to verify "the adequacy of the student's preparation for undertaking research in a chosen field and [assess] the student's ability to synthesize knowledge already acquired." The exam is not designed to reevaluate the student's knowledge of coursework specifically, but instead should be focused on discussing potential dissertation topics, test the comprehension of their research area, and "probe the limits of the student's technical knowledge in related areas."

[1] https://www.aep.cornell.edu/aep/programs/graduate-programs/doctor-philosophy-applied-physics/exams

[2] https://www.seas.harvard.edu/office-academic-programs/graduate-policies-procedures-and-forms/phd-degree-requirements/phd-qualifying-exam-end-g2-year

8.2.2 Applied Math

NYU (course-focused written exam + course-focused oral exam) [3]

In Years 1-2, students take written comprehension exams in Advanced Calculus, Complex Variables, and Linear Algebra. Examinations are given twice a year in late August and early January. Students may take the examination twice without special permission. A third try will require permission of the Director of Graduate Studies. In the fall term, workshops are hosted by the department and taught by an advanced graduate assistant. In Year 3, students have their oral examinations with a general section and a special section, each lasting one hour. The general section consists of five topics including complex variables, real variables, ODEs, and PDEs. The special section is devoted to a single topic chosen together with the candidate's advisor and related to the candidate's Ph.D. dissertation.

Brown (course-focused oral exam) [4]

In Years 1-2, students have an oral examination covering four topics. Two major topics are examined during a two hour session. Two minor topics are examined in another two hour session. Topics should be chosen from: analysis (real and functional), dynamical systems, fluid mechanics, numerical analysis and scientific computing, pattern theory and statistics, PDEs, and probability and stochastic processes. Minor topics should be chosen from: mathematical methods, biology, computer science, economics, engineering, or physics. Alternative topics may be proposed, subject to approval by the Director of Graduate Studies.

Princeton (Course-focused oral exam) [5]

At the end of Year 1, students will take a preliminary oral exam covering three topics. Topics can be chosen from the six categories: (1) Asymptotics, analysis, numerical analysis, and signal processing, (2) Discrete mathematics, combinatorics, algorithms, computational geometry and Graphics, (3) Mechanics and field theories (including computational physics/chemistry/ biology), (4) Optimization (including linear and nonlinear programming and control theory), (5) Partial differential equations and ordinary differential equations (including dynamical systems), and (6) Stochastic modeling, probability, statistics, information theory. Before Year 3, students must pass a general examination, which is a sequence of interviews that covers three areas of applied mathematics. Students may retake the general examination a second time. If a student fails a second time, then candidacy is automatically terminated.

UCLA (course-focused written qualifying exam) [6]

Students must pass three written qualifying examinations, one basic and two area examinations. Upon matriculation into the program, students take the basic examination. Students who fail are advised to create a study plan that leaves time to prepare for it. Students must pass the basic examination by the end of their sixth quarter. The two area

[3] https://math.nyu.edu/dynamic/phd/phd-mathematics/written-comprehensive-exams/
[4] https://appliedmath.brown.edu/graduate/prelim-information
[5] https://www.pacm.princeton.edu/sites/default/files/pacm_guidelines_2021_1.pdf
[6] https://grad.ucla.edu/programs/physical-sciences/mathematics/

examinations are chosen from the following seven options: algebra, applied differential equations, computational mathematics, geometry/topology, logic, optimization/numerical linear algebra and real and complex analysis. Students may take each area exam up to four times. One area exam must be passed by their sixth quarter, and the second by their seventh quarter. After the written exams, students are expected to pass an oral exam by their ninth quarter.

UW (GPA requirement + research assessment) [7]

Before Year 2, students must pass with a grade of 3.4 or higher six courses from: Intro to Probability and Random Processes, Advanced Stochastic Processes, Inferring Structure of Complex Systems, Applied Complex Analysis, Advanced Methods for ODEs, Advanced Methods for PDEs, Applied Linear Algebra and Intro Numerical Analysis, Numerical Analysis of BVPs, and Numerical Analysis for Time Dependent Problems. If a student does not attain a grade of 3.4 or higher in six of these courses, a student has the opportunity to address this in their second year, provided they attempted six of the above courses in their first year. There is no written qualifying examination. Prior to Year 3, students must pass a general examination consisting of a written thesis proposal, a public thesis proposal presentation, and a private oral examination.

8.2.3 Materials Science Programs in top 5 (US News Rankings)

MIT Department of Materials Science & Engineering (GPA requirement + research assessment) Recently reformed in 2021. [8]

Students have no qualifying exam but must satisfy the following: Students show competency in the core knowledge of Materials Science and Engineering through the results of their examinations in each core subject. In the first two semesters of the graduate program, doctoral track students enroll in the four core subjects: 3.20 Materials at Equilibrium, 3.21 Kinetic Processes in Materials, 3.22 Structure and Mechanical Properties of Materials, and 3.23 Bonding and Electronic Properties of Materials. Students enroll in these subjects for a letter grade. Students must demonstrate mastery of the discipline by satisfying the following requirements:

1. Earning a 4.0 GPA (out of 5.0) in the four core subjects
2. Earning no more than one C in the core subjects
3. Satisfactory performance in research in the first two semesters of the program, including completing the milestone of selecting a research group in the Fall term and receiving a "J" grade in 3.995 First-Year Thesis Research in Spring term

Stanford Materials Science (Research assessment only) [9]

[7] https://amath.washington.edu/qualifying-examination
[8] https://dmse.mit.edu/graduate/programs/doctoral/qualifying-exams
[9] https://mse.stanford.edu/academics-admissions/doctoral-program/program-requirements

The exam is a 2 hour long, begins with a 20-minute research lecture given by the student followed by questions about your research and detailed questions in the 200-series core subject areas.

UCSB Materials (GPA requirement and two research assessments, separated into a preliminary exam in year 2 and qualifying exam year 3) [10]

Preliminary exam taken in the 2nd year: a 10 page paper on research + 30 minute research presentation PRELIMINARY PAPER At least 3 months prior to the examination date the student's advisor will assign the student a specific topic relevant to his/her intended research project. The student will research the literature on the assigned topic, identify key outstanding issues and/or research opportunities, propose ideas on how to address these issues and/or exploit the opportunities, and outline a tentative research plan. The student is expected to prepare a short document (10 pages of text maximum, plus figures and suitable references after the text) summarizing his/her findings and ideas. Refer to the section above for formatting guidelines. The document must be submitted to the committee and the Staff Graduate Advisor at least one week before the examination date. PRESENTATION: The student will present a 30-40 minute seminar outlining his/her findings, ideas and prospective research plan. After the presentation, the committee will probe the student's understanding of the subject, his/her knowledge of the fundamentals of materials science relevant to the problem, and his/her ability to think soundly and creatively.

The Qualifying exam in the form of a "dissertation proposal" report and presentation. The examinee must submit a formal dissertation proposal (maximum 10 pages of text plus a sensible number of figures and a substantial list of references both placed after the text) that summarizes the intended research problem, the research approach, results to date, and future directions. This proposal should be submitted to the examination committee and the Staff Graduate Advisor at least two weeks before the examination. (Failure to deliver the thesis proposal to the committee on time may result in postponement of the examination.) PRESENTATION The format of the examination includes a 40-45 minute presentation of the dissertation proposal by the student, during which time only questions of clarification will be allowed. The presentation will be followed by questions from the committee for a total period of approximately 60 minutes. Completed year 3.

Northwestern Materials Science & Engineering (research assessments only) [11]

Preliminary exam after the first year where the student submits a 1 page writeup summarizing research progress to date. Student must have GPA of 3.0 GPA. Qualifying exam: The Qualifying Examination is comprised of two deliverables: a written research proposal and an oral research proposal presentation, both presented to the Thesis Committee (discussed below). These deliverables should persuade the Thesis Committee of the scientific merit and feasibility of the proposed research project. Students use these deliverables to educate and persuade the Thesis Committee that the proposed work is novel and that the

[10] https://live-materials-ucsb-edu-v01.pantheonsite.io/sites/default/files/images/gsr_manual_2021.pdf

[11] https://www.mccormick.northwestern.edu/materials-science/documents/phd-handbook-2021-2022.pdf

student's approach is practical and appropriate. In persuasive proposal writing, the writer must demonstrate the merit of their ideas by demonstrating logic and reason in their approach to addressing the questions of interest

8.3 Testimonials on why students considered leaving the program because of quals

8.3.1 If you've ever considered leaving the APAM program, were quals a consideration? If yes, please explain.

- The rote testing paradigm is a poor representation of one's ability to work in the field and reliance of evaluation on it is demotivating to those who perform well in the field but poorly on tests
- The level of stress and lack of clear guidelines for the written exam made me wonder if it would be easier to drop out before taking the exam as opposed to sitting through the whole study + exam period and then failing.
- Quals does not test my ability to research, which is what I am here for. I passed my classes and their respective final exams. So quals makes me wastes time restudying classes I passed a while ago instead of doing what I am here to do. It was a waste of time, frustrating, exhausting, and unnecessary.
- Quals caused me an extreme amount of stress and anxiety, which resulted in loss of sleep and a decline in my mental and physical well-being. Quals made me consider switching to a different department or university entirely.
- Our written qual and thesis proposal are fine and useful from my perspective-Princeton is even more strict on these two. However, there are two complaints about the oral qual. 1. It typically happened one year after written qual when students have devoted completely into research, however, the content is completely irrelevant with research. Purpose-wise, it is duplicated as oral. As such, maybe it could be combined with the written qual time period and let the students answer their unfinished written qual questions orally or something like that? 2. Although claimed to be based on the same courses as written qual has tested, the oral qual does not have a solid standard neither among different subdivision of optical physics/ plasma physics/materials science majors nor within. For example, some students were allowed to have their supervisor/self-chosen faculty as committee members while others were not.
- Not passing the qual made me seriously consider whether I wanted to stay in the graduate program at Columbia, although in the end I'm happy that I made the decision to remain
- Knowing I could put in two good years of research but still get kicked out if I failed the quals twice made me not want to risk it and end up wasting two years.

- In the weeks leading up to the quals hen I as studying every waking moment I had a very strong urge to leave the program if I didn't pass them since I didn't want to go through that again

- In the final month of the spring semester it felt like the combination of performing well in my class finals and adequately preparing for the written quals was beyond my capabilities, and the timing of the quals in that regard felt inconsiderate of the department. These two factors led me to consider if another phd program would be better suited for me.

- If I had to retake written I would have left.

- If I did not pass the written quals on the first attempt I think I probably wouldn't have even attempted to take it again. I had an excessive amount of anxiety surrounding the written quals, and if I didn't pass I don't think I'd be willing to go through it all again

- I felt that there were several unfair factors related to the quals and the first year. First, one question that was completely unrelated to the relevant course associated to that question. Second, the need to memorize questions. Three, how one very narrow and specific question is supposed to judge a whole course's relevant information. Four, how we barely have time to study with the amount of coursework expected. Five, how the quals are a weed out/expected test rather than a more helpful placement test that helps you learn your insufficiencies. Six, how we are extremely talented students who are given further examination tests to prove our worthiness of the program. Seven, how we should be learning research not coursework and how to take a test. Eight, how closed the process is - I believe it should be open so we understand exactly what is going on. Finally, I believe many other programs would feel lucky to have us and not put up these barriers. As an example, the physics department has placement tests instead of a written qual as well as a oral presentation at the end of the year which judges research ability rather than examination taking ability.

- I may have left after the first year had I failed quals. After getting the masters, there would have been ample opportunity to go elsewhere to comparable programs with more forgiving quals situations.

- I am currently considering transferring to a different department in part because of the quals system in APAM, and in part because of the lack of breadth and inclusion within materials science. The demographic information I indicated for my year and subfield can relatively easily identify me; therefore, I will not hold back but rather detail my full opinion and experience as objectively as possible. I focus on the written exam and oral exams and refer to these as quals, excluding the thesis proposal.

  My general sentiment regarding the manner in which quals are handled in APAM is confusion; confused by the exam variations between sub-programs, confused by the lack of clarity and communication throughout the process, confused by the content and timing of these checkpoints.

My sentiments surrounding my experience with quals in MSE are disappointment and frustration. I have repeatedly witnessed this sub-program mislead and detrimentally affect its students (undergrad, masters, doctoral), setting unrealistic expectations of what is considered basic/prior knowledge and emphasizing material that is relevant to a limited subset of its students.

Stemming from this, I would like to point out the inherent nature of survivorship bias – focusing on a population that has previously passed through some selection process, in this case this survey being limited to those who are still current APAM students. It could very well be that the limited number of those who remain are well-suited for and/or fine with the current quals system. In acknowledging some voices I am familiar with, of those who have left the program for quals-related reasons, all of them could perform research satisfactory to their research advisors and collaborators. However, they were stifled and prevented from demonstrating their scientific strengths, unable to showcase their potential and progress as researchers.

I find it completely paradoxical that it is very possible to begin conducting substantial research and even publish within the first two years yet still be at risk of dismissal from the doctoral program solely based on coursework and 'basic knowledge'.

I have elected to withhold the more personal and lasting effects that these exams and the philosophies that they represent have had on both myself and some of the students that have remained in and departed from the program. There are sentiments and experiences that would not be proper to share without their consent, but it is needless to say that they are silent screams gone unheard.

I personally have no issue with multiple written and oral assessments for quals, however the nature of the current exams are (1) redundant, (2) removed from our journey/work as researchers, and (3) outdated under premises of 'tradition'. I find this especially true of the MSE quals here, and APAM as a whole does not properly convey this to their incoming students.

The written quals are scheduled to follow spring exams with a 1-2 week turnaround time. Given that content from the 3 spring courses were still fairly fresh, in theory, the focus of this short period would be to review material from the 3 fall courses (in addition to linear algebra or PDE). In theory this seemed manageable, and while not an easy or simple task by any means, it was doable.

Now then, this begs the question, why is this the format of choice for a qualifying exam? We already have multiple exams of a (very) highly similar format throughout the semester over the exact same content, which in practice was much more detailed than the written quals. Why then is there another test so closely following final exams, which should already be the culmination of an entire semester of information? It follows that, why is there another exam over the exact same material, now administered verbally, a full year later? Therein the written and oral exams lie a high degree of repetition and time taken out from research to frankly re-learn much of the material that is now farther removed from our current work.

The case has been made that this should be no problem because we've spent so much time in class with these details and that they are fundamental to 'materials science'.

Yet this is a hollow argument that hinges on the fact that written quals are more manageable because we were more actively focused on classes in our first year. I would agree that in a general capacity, I retained the concepts and philosophy from these courses. However, just as a practicing physician likely doesn't remember the nuanced mechanisms of organic chemistry, my work is dependent on the basic theory of materials but more predominantly concerned with factors far beyond and far removed from the scope of topics mentioned in class.

By the second year, I felt even more removed from our first-year coursework. . . . [identifying information]... In addition to this growing sense of unfamiliarity and distance from the content of our written quals, I have consistently felt that my research and work outside of classes has been ignored by the department in any official or casual capacity.

A core part of our time here, and arguably the most important to our post-doctoral careers, is our time as researchers. And while the department website advertises (much like that of other departments and other schools) that 2 out of 4 criteria for evaluation at the end of our first year is research related. So the first issues are the disparity between what is detailed and the actual nature/content of each exam and what is broadly described as the philosophy of the exams. This hollow promise and lack of research support from the department as a whole has always felt to me that the message most clearly conveyed is that our priority is not research for at least two years, and the diminished importance of having sufficient time and mental capacity to focus on finding proper research groups and beginning to conduct research.

Yes, the materials science core curriculum is rather comprehensive, and it feels important to have a good grasp of these concepts. I agree with this. Some amount of assessment to gauge our understanding of fundamental concepts is important. However this amount of focus on just course materials and the fundamentals as they are in isolated settings is extreme.

What confuses me even more is the differentiation between how the oral exam is handled between materials science year to year and the other subfields in APAM. While the oral exam in applied math and applied physics involves the advisor (and the student to some extent by relation) to tailor the exam to each student, MSE retains the older, redundant format of a generic course-based exam for their students. The AP/AM format appeared to be similar if not identical to that of MSE 4-5 years ago, as stated by a senior member of my group and our advisor. Furthermore, my own advisor (materials science) was unaware that he no longer played a role in deciding the oral-exam committee as opposed to back then. This is indicative of underlying communication issues present within the department, but that is a different grievance.

If the department wishes to give an oral exam about core material, I and my current advisor would have rather had some input as to the nature of my current research and topics that were still relevant for our work. This re-emphasizes not only the lack of attention to our search for research groups and research interests, but also the lack of interaction and communication with the department from the beginning of our time as doctoral students (in addition to a break in communication between key faculty).

If this department is to properly prepare its doctoral track students for their future

careers in and out of science, I genuinely believe that it is to the benefit of the students, research advisors, and department that the way students are managed within their first two years here is reformed. Other departments at Columbia, in SEAS and GSAS; other materials science programs at equally esteemed institutions like MIT, Stanford, Cornell, UPenn, UChicago, Northwestern; other doctoral programs of other fields have all moved away from the traditional course-based examination in favor of qualifying exams that push the students to research their field of interest and create a proposal of sorts (written qualifier), then later present initial findings and be able to contest their relevance to course-material and the greater contribution to the scientific community (oral qualifier).

These types of exams can still incorporate the fundamental assessment of coursework (if a committee so desires), but more importantly would – from the start of their time as doctoral students – better help acclimate and train students to frame the coursework and their own research in a larger context and draw relations between the classroom and lab. Additionally, this type of early assessment of and training of our ability to write grants, develop ideas, present findings, and get feedback from multiple faculty members would further students' opportunities to additional resources like fellowships or grants only available to new graduate students, which subsequently benefits the faculty as well in securing more resources to conduct research.

Furthermore, departments within Columbia like Physics (GSAS) and Chemical Engineering (SEAS) have already begun implementing this type of qualifying exam in addition to semesterly advisor-student evaluations to both institute periodic check-ins on progress and research capacity, which all factor their quals assessment as a more individualized and accurate long-term, 'time-averaged' representation of each student's progress. This way, the department, advisor, and student have regular chances to address issues and fix them throughout the year as opposed to the evaluation of a few single (and at times arbitrary) instances in our career here.

I have consistently felt that this program and the culture that the qualifying exams in the first two years promotes a very siloed, isolated environment that solidifies our labels as either students or researchers, making the transition and eventual merging of those identities much more difficult than necessary. I have felt that my interactions with peers in this time have been hollow, revolving around the courses and wanting to continue our work in this program as opposed to deep, genuine, intellectual conversations about our research that further our understanding of our own work, their work, and potential ideas for the future.

While I have been told that the quals system 'cannot be changed after our acceptance to the doctoral program', there have already been documented instances of this agreement being broken or having their terms and conditions slightly altered here and there without prior communication to the students. No one will oppose changes that would serve to lessen stress, set our sights beyond the classroom and grades, and establish a system of reliable, accountable feedback and communication between students and faculty – all things that would only improve the department and student experience. As we have chosen to confront our concerns and speak out for the first time in a more

official setting here, it is now in the hands of the faculty of this department to meet us halfway and communicate with us face to face.

The students have no power in changing this construct without the professors administering these exams. And if the faculty continue to turn a blind eye to the genuine concerns of their own students, then they have betrayed not only the current and future students of this department, but perhaps their own desires for a more ideal path to candidacy in their own pursuits years ago. To initiate the first steps in creating positive, impactful, lasting change is a responsibility and privilege available to few. In this power lies as an untapped resource within the faculty that should be exercising to not only maintain relevance in an ever accelerating world, but to emerge ahead of the curve and lead and shape the future of science and education.

8.4 Mental health quotes on studying for the written exam

Responses to the question "How did you feel mentally and physically during your preparation leading to the written exam?"

- Awful. Both my physical and mental health deteriorated greatly, especially during the time in between finals and the written exam. I did go to counseling every week of this year, but anything I did that was to take care of myself was always accompanied by guilt that I wasn't studying. I felt similar guilt when I decided to deal with the minor medical issues that surfaced for me this semester. Now having failed the exam I feel affirmed in that guilt. [identifying information redacted] I struggled very hard with knowing that I shouldn't put the exam before my own health but feeling like I needed to to succeed.

- Bad... I generally don't have much testing anxiety, and ultimately knew I would more than likely pass, but I will admit that I had nightmares and anxiety dreams the entire month leading up to the written exam (not even dreams related to the exam, just generally bad dreams), and so I got very little good sleep. I don't think i've ever been that stressed while simultaneously being as organized and prepared as I (in hindsight) was. What was especially challenging was the absolute (and what seemed to be apparently intentional) lack of clarity on what it meant to pass or fail

- Both mentally and physically, I felt fine. For a long time prior to the quals, I was growing concerned over my inability to stay awake while studying getting in the way. About three weeks before the quals, I started a new medication that my doctor (who I'd seen, referred to through Columbia, weekly for the past 1.5 years for anxiety and AD/HD) prescribed me, assuming I had insomnia. It immediately fixed my lethargy issue and I had a few weeks of quality studying that left me feeling confident going into the exam. I still had concerns about losing points due to dyslexic mistakes and expected to lose points due to being asked things my classes never covered, but I felt confident that I knew enough material thoroughly enough to pass despite these concerns.

- Definitely stressed, but I felt prepared.

- Drained
- Felt fine but had to self-study a lot
- Felt prepared
- Fine
- Fine, although the pandemic made the experience of preparing for quals more isolating than I think is typical
- Honestly, it was very stressful and draining, but I think that is a very important step in learning to be an expert mathematician. I hadn't felt so much pressure for an exam before, and I think I needed to experience that.
- I am okay with it. It is stressful, but a good experience in life.
- I am very stressed. I typically do not do well on exams. There is too much information to remember, and the time I spent the most is to keep remembering and forgetting. And after a year I forgot most of them. The time (several months) could be put into better use. My first paper was stalled for almost a year and a half because of these exams.
- I did not seek mental/physical help during quals prep, but for most of the time leading up to quals, I did not go outside/socialize/prepare healthy meals/spend time on hobbies or to relax very much because I believed that I didn't have the time, which was not fun. I didn't feel prepared despite spending a lot of time on the material and I would not be willing to go through that kind of extended period of high stress and lack of personal life again. Although of course I continue to work hard and have busier crunchtimes still, my life is a lot better for having more balance.
- [redacted as potentially identifying]
- I feel good except the day before the exam days.
- I felt extremely stressed out during the preparation. The qual covers a wide range of content so there seem never enough time to prepare for all the questions. Also there is never a clear line on how we could pass the written test so we have to push for all 8 questions. So the whole process is pretty stressful. One sign I know my body was experencing extreme stress is I kept diarrhea during the last month. I know there should be something wrong with my body but I just don't have the time to see a doctor. Mentally-wise, I experienced emotional meltdown after the first day of qual. I was lucky as I had my partrner to hug me during my mental meltdown. As a person who had to reach out for counseling service just one year ago, I felt I was lucky enough to "only" have emotional meltdown in the very end and I had someone with me at that time so I didn't do anything stupid.
- I felt extremely stressed, but that mostly came from the repeated delays of the actually exams due to COVID.

- I felt fine.
- I felt fine. This was probably the sixth or seventh year in row of the same deal with end-of-year exams going to back to mid high-school. The exam was harder but the yearly preparation etc hadn't changed. So it felt more or less like the same recital. In a sense it is one of the least stressful times because you know exactly what you need to do and your timetable gets cleared because of it. It was exactly the same again the next year for the oral exam.
- I felt mentally and physically healthy leading up to quals. I was surely more stressed than normal, but all in all never to an extent that felt unhealthy. Having a group to study with was a huge benefit for me, both academically and psychologically, especially during covid.
- I felt nervous before the exams, but then felt good.
- I felt ok. I only spend less than a week doing past exams. But I felt like I was preparing for something not very meaningful.
- I felt prepared after spending months studying.
- I felt stressed out before the written exam. I believe everyone else was stressed out, too. There were six other PhDs in my year; two quit before the exam, and the other four were extremely competitive. We do not have frequent communications before the last week. The "you pass, or I pass" environment was very toxic.
- I had so much stress that I could continuously fee it in my chest. Mentally, I was completely exhausted and drained spending every second of my being devoted to the quals. I did not have time to go for walks or work on my physical health. I also had problems with my mental health. On top of this, there was a recent death in my family soon before the quals which affected my coursework and studying preparation. In addition, I had published a paper and was supposed to present at a conference, but I decided not to go because quals put too much pressure on me and I was worried I might fail the quals if I went.
- I personally had a medical issue leading up to the written exam that made it a bit more nervewracking, but otherwise the stress was mainly mental. I felt as prepared as possible, but obviously was still very nervous for such an important exam.
- I started going to Columbia Psychological Services therapy as a direct result of not passing the qual the first time around, and in general due to the stress of studying for it the second time. Studying for the qual is an intensely stressful experience. I do not believe there were any unique or extenuating circumstances that would have made quals more difficult for me specifically. I feel that the classes, other than classical mechanics (which was not taught towards the qual, as it was taught outside APAM) did a reasonable job preparing me for the exam.

- I took the written quals after they were postponed to September due to COVID. I genuinely do not think I would have been able to pass the qualifying exams had they occurred the week after finals as normal. The amount of workload already expected from classes on top of the extra studying required for written quals is a lot. I spent about a month studying 30 to 40 hours a week for the exam and still only felt somewhat prepared for it. Mentally, I honestly think that month was one of the most stressful of my life because of the how much material we were expected to know and the importance of passing the exams, while also combined with how unclear the expectations were for what was a 'passing' performance. I personally struggle with exams a lot, and the pressure to do well on this one exam was pretty detrimental to my health. The fact that there were no solutions provided to previous qualifying exams made the studying process much longer and more difficult, because after solving problems from old quals (I spent a lot of my study time doing every old qual we were given), all of my cohort had to get together to try and figure out if we did it right or how to solve it if we got stuck. I understand wanting students to figure it out on their own but I was always concerned that I was continually reinforcing mistakes that I couldn't check and fix with solutions, which is not helpful and wasted a lot of my study time.
- I was a bit stressed.
- I was already burnt out from finals in the week leading up to the written exam.
- I was lucky to have a supportive professor tell me early on that I could always re-take the quals and that it wouldn't be immediately viewed as a referendum on my intelligence or worthiness to be in the program. However, I was still very nervous throughout the process, particularly when covid happened and I ended up studying largely in isolation.
- I was mentally and physically exhausted preparing for quals. All of my free time outside of courses/TAing duties was spent studying without time for anything else.
- I was pretty anxious even though I felt I had studied as best I could because of the huge repercussions of failing - the risk of expulsion.
- i'm stressful mostly because of the high passing rate heard from senior students and there's no explicit standards for passing the quals. besides, i personally do not like the time for the qual since it passes the lunch time.
- I'm under pressure. I always talk with my pals to release a little bit stress.
- In terms of stress, sleeping habits, eating habits, and exercise habits (or lack thereof) leading up to quals, I certainly was in an unhealthy and unsustainable state. I did not seek external help (not that I would have had time to). Uncertainty about whether classes I took had prepared me well for the questions on the qual definitely heightened my stress, as I felt there were things that I was unaware I was supposed to know.
- It was awful. I could not justify to myself doing anything besides studying from when I woke up to when I went to bed not taking breaks that were longer than like 20

minutes for the two weeks leading up to quals. Honestly even if I started studying earlier I think I would have done the same thing since there is just so much that we're expected to know going into it. My eating habits got worse and I lost 5 pounds in the two weeks (and my BMI was like 17 to start with), I rarely showered, and I pretty much never left my apartment; to an outsider I was showing signs of severe depression. I should have sought counseling but I don't see what it would do besides just having me voice my frustrations out loud which wouldn't change the reality that the exams were rapidly approaching and I felt extremely unprepared. Suffice to say my mental health deteriorated to the lowest it has been since high school when I was hospitalized for anorexia. If I had not gone to therapy in the past and learned how to work through a lot of underlying mental health problems I have I probably would have needed hospitalization again.

- It was fine.
- It was stressful. Never felt fully prepared.
- Let them know fighting off the feelings of isolation and anxiety and depression were real. And while it was helpful studying with others, at times maintaining my compusure and mentality around their spiral into defeatist mindsets and their own anxiety/depression were challenges on their own. Thoughts and to some extent actions of self harm, unhealthy diet, and irregular sleep wre all present.
- Mentally and physically I was anxious and probably depressed, though I expected that. It is a stressful exam and experience. I found quals more difficult due to an inferior undergraduate education - for example, there was only 1 class offered every 2 years on quantum mechanics and it only covered chapters 1-4 of Griffith's. I did not feel prepared going in. Most students entering the program come from very reputable institutions and so the qual may be an inconvenience for them, however for students coming from less reputable institutions the quals are an opportunity to gain equal footing with their peers.
- Mine were prepared for at home out of state during covid, many months after my last class had ended, no other grads around. I did not particularly enjoy the experience, the massive amount of stress definitely destroyed my sleep for a week or so before the day itself and my eating and otherwise was quite poor the few days leading up to the exam. I did not seek counseling or medical help.
- Much of the difficulty of the quals came from uncertainty on what will be tested. Usually a professor teaching a class will state or heavily imply that certain concepts will not be tested because they did not spend much time on it. It felt, however, that there were no such restrictions on the quals. It felt like even advanced / peripheral topics that were merely brushed in class could be quals questions, thus even though I did well in my classes I was very nervous that I would encounter quals questions I am not prepared for.

- My anxiety got really bad spring semester. It got so bad it exacerbated my pre-existing insomnia and I was getting 4 hours of sleep. I was always so busy with work from classes, TAing, and studying for quals that I felt as though I couldn't make time to take care of my mental and physical health.

- My mental and physical health definitely deteriorated during the few weeks leading up to quals. Since I was so preoccupied with studying and felt guilty whenever I wasn't studying, I did not take time to take care of myself. Most of the meals I ordered out and I did not take time to exercise. I did seek out counseling through Columbia CPS prior to preparing for quals during the fall semester and beginning of spring semester, but I canceled my sessions a few months before quals so that I could spend more time on studying. In retrospect, I wish I had not canceled my sessions since I could have benefited from counselling during this stressful period.

- Nervous and tired

- Physically I was fine, mentally I was stressed. Thankfully I have a lot of support (my wife helps a lot and my parents live nearby) but the time was still very stressful and many people had it much worse.

- Physically– weak, since I neglected any semblance of physical well-being in favor of preparing for quals.

  Mentally– In the weeks leading up to the exam I felt very firmly on the verge of a nervous breakdown every day. I started eating and sleeping much less, and had headaches every day for about a month. I had such intense anxiety surrounding the quals (and finals as well, since I had neglected those to study for quals) that I could not sit down to study without shaking.

  Then came a critical point, about a week before quals, when I realized that I shouldn't care nearly so much about the exam. I decided that I didn't care if I passed or not. In reality I very much wanted to pass, of course, but I decided that if I didn't pass– after having done well in all of my courses and sacrificing two months of exercising, socializing, and just generally enjoying my existence to intense studying– then it would have been a consequence of a broken system as opposed to insufficient preparation on my part. Surprisingly, this shift in my perspective actually made it much easier to study. I studied a good amount in the week leading up to the exam (probably 10 hours a day for three days), but in the handful of days leading up to the exam I decided to stop studying completely. I am glad that I passed, but I have never been so stressed about something that I had to adopt utter apathy as a coping mechanism. And that's pretty scary to me.

- Qual prep was an incredibly stressful experience, considering both the amount of time available to actually study, as well as the general fear of doing poorly.

- Quite stressful.

- Some of the questions are decribed vaguely. It is better to have more clear description or more quantative questions.

- Stressed over the fear of failing and exhausted from studying all day and weekends. I had a hurt foot which prevented me from exercising which would have helped manage my stress. Put a strain on my partner and I's relationship due to mental and emotional exhaustion.

- stressed. it was during summer 2020 so i was at home [identifying information redacted] alone. i had no idea if i was prepared or not

- The qual exams were an awful, traumatic experience that I would not wish on anyone, and makes me wish that I had applied to a different PhD program within SEAS. I did not learn more than I did by just passing the courses, it only created trauma for me, delayed my research progress, and made me disrespect APAM's faculty for upholding this useless exam. If anyone wants to apply to APAM, I'll suggest they check out other departments first specifically to circumvent APAM quals compared to other similar programs here at Columbia. Our quals require memorization of way too many formulas and concepts for a two-day period. A human mind is not meant to pack all of this memorized information into their heads for such a small amount of time, this is why finals in university are purposefully not all on the same day. These memorization based exams are not effective, I can confirm that I forgot most of these formulas a week or two after the exam. The main concepts are what stick with you, which is what I already got from just taking the class. At least courses gauge long-term effort and understanding and include several exams and assignments, so it doesn't make sense why we have to be examined via quals on the same exact topics, when we already just passed the courses. It's clear these quals are a result of professors not respecting their own grading systems to the point that they don't trust that their students learned a baseline knowledge from just taking their courses. The most ridiculous part is, the professors that write this exam, half of them did not have to go through quals like ours at all (they had research assessed quals only), and yet, they seem to have done just fine in academia. There is no way to justify these quals when many top PhD programs higher ranked than us require different quals (assess research capabilities instead). Clearly your PhD students are abnormally unhappy due to these exams– I hope the faculty take the opportunity to make quals a more positive, manageable assessment for students to help make APAM a world-class, modern grad program that is inclusive to people of all socioeconomic backgrounds.

- The time leading up to the exam was the worst part for me. I was fine once I was taking the exam as I usually am, but during the period leading up to it my anxiety was worsening and I began having panic attacks especially in the last week before the exam. I sought medical help for this through the school months ahead of the exam, but due to the national mental healthcare shortage I was unable to attain any form of long-term care before the exam (and still now). Additionally, during the two weeks leading up to the exam I considered health care a time sink that could not fit in my studying budget.

- The week between my last final and the quals was terrible for my mental health. I had two mental breakdowns in the first two days of that week because the task seemed to

be beyond my capabilities, and standing between me and my personal destiny. The timing of the exam made it much harder for me. To expect all students to be able to study for the quals while taking a full course load during the spring is unrealistic, and the reality that this expectation creates is that many students had 1 week to review 8-9 course. In my experience, such a short study period for such a large amount of material forces a student to cram information and drill specific problems, instead of developing a deeper understanding of the fundamental theory, which i believe is a primary goal of the quals.

- To be honest, I spoke to a few older years [identifying information removed], and a worryingly high number of them failed the first time. This didn't make me feel great, but what else can you do other than knuckle down. In the end, the exams weren't that bad. I don't how high above the pass line I was, but I felt on the day I knew enough to pass. I definitely feel they are made into a very big thing, as if the exams are this 'Great Filter' to weed out the weak amongst us, but in the end it was just another exam like any other final exam, just longer and with a much broader set of examinable material. The fear of failing the exams crept up again and again, perhaps more so because and to not continue in the programme is synonymous with having to leave the States, but again, as I studied more and more, the fear subsided proportionally, until on the day when I was pretty confident.

- Was feeling nervous and unsure.

Responses to "How did you feel mentally and physically while taking the written exam?"

- Mostly drained. Especially on day 2, all I remember thinking in the short time between solving problems was that I just needed to keep going and get over that hill. Every second I was closer to being free of the awful burden that hung over my head ever since being accepted!

- Fine. Couldn't do anything but answer the questions at that point.

- Upon opening the exam, I was met with a worst case scenario. I felt very confident in roughly 80% of the material I was responsible for knowing, confident enough to figure it out on another 10%, and knew I would lose points on the remaining 10% of material (not enough quality time of studying to get to these topics). When I read through the test, I noticed a relatively disproportionate amount of questions targeting that last 20% of material I was less confident on. Upon starting to work through problems I made a simple dyslexic mistake that caught me off guard enough that it flustered me through the rest of the test. While these issues aren't uncommon in working through material, outside of a test I can quickly sort myself out by deriving formulas I want to use, plugging in my work to something like Mathematica to "spell check" me (so to speak), or reference a formula in a textbook to be certain I am recalling it correctly. On a test, particularly on one of this level of importance, the pressure puts you in a deer-in-headlights sort of state that makes it near impossible to see yourself around such a

mistake. Having encountered this issue at the very start of the exam, it plagued my mentality throughout the exam and caused a spiral that prevented me from effectively answering the questions I was tasked with, even on questions I was very confident on...

- I was somewhat stressed but not more than usual for a big exam.
- Still drained
- Very good during the exam
- OK
- Fine
- Fine, I think splitting the exam into two days makes it more manageable and improves performance
- I felt fine. It would have been nice if it started on time.
- ok.
- I am stressed. The exam is long and I barely finish it.
- not great
- N/A
- nervous
- To be honest I felt very focused during the exam. However there were time that my tear came out of nowhere.
- I felt mentally stressed, but I often do when it comes to taking exams.
- Fine.
- The night/morning before the exam is always nervous, it would be unimaginable not to be nervous given its importance, but once the exam starts it's just focus/concentration for 4.5 hours.
- I felt mentally and physically healthy during the quals.
- nervous, but ok then
- Like any other exams
- Tiring
- Just want to finish it quickly and a little bit released after the first day's exam.

- I already mentioned the physical stress that I could feel in my chest near my heart. However, when I saw there was a question that completely unrelated to the course I took and the material I studied - I almost had an anxiety attack. On the second day, I actually felt extremely calm and confident but it was only because some of the questions I knew from past research experiences and knew everyone else probably did not know the answers (which probably caused them considerable stress).
- Honestly not as bad as I expected - during the exam I think that the act of working on problems provided a distraction in a way from worrying. I felt more stress before the exam and awaiting results than during the exam itself.
- Reasonably calm
- I felt normally stressed out the first day, but the second day I was going very slowly because I was getting tired. I started to kind of panic because I was running out of time, and I made some pretty obvious mistakes on some questions that I knew were wrong in the moment but I didn't have time to fix them. I don't think the exams should necessarily be longer because they're already 8 hours long, but I felt very crunched for time and I think it negatively affected my performance.
- I was stressed.
- Burnt out
- Nervous.
- The first four hour exam was tiring but fine. Taking a second four hour exam the next day was brutal.
- It was a roller coaster. Two questions I should have been able to answer I struggled with, despite strong performance in the relevant courses and a solid conceptual understanding of the material. Then for two other questions it was immediately obvious that professors had neglected to write a relevant question and it would not be counted. I was frustrated with myself for having difficulty with two questions, relieved that I wouldn't have to answer two more, and frustrated with the department for making me stress over these two fields that they clearly didn't care enough about to write an appropriate question.
- i don't really recall any feelings during the exam. guess just hungry during the last two hours and i don't like eating when doing problems.
- I slept for two whole days.
- I did not feel any worse than I do during a typical exam.
- The first day was ok. Mechanics, Quantum, and the math I chose were all pretty reasonable questions that were in the class / on previous quals so I was prepared, and the electrodynamics question was so out of left field that I knew that everyone was

going to get it wrong so I figured it was going to get thrown out so I only needed to try and use some physical intuition.

Day 2 was pretty much sheer panic the entire time. The kinetic theory question was free but the other 3 were on topics I pretty much did not study at all. I had spent probably 50-60 hours studying plasma waves and deriving every dispersion relation under the sun just to have the 2 fluid question suddenly not be on 2 fluids at all (I noticed that the question was just called "plasma B" this year when it's usually called "plasma B- 2 fluids" which is unacceptable to do with no prior notice). If I hadn't joked around about adiabatic invariants with the other plasma students when we were getting lunch after the day 1 exams I would have likely failed that question completely.

- More or less fine.
- Tired and bit stressed, though not nearly as stressed as the lead up to the exam.
- I honestly nearly vomitted from the stress. And because this is not adressed elsewhere, in receiving the results for this exam, we were given a less than one hour notice. I happened to be in public and could barely stay calm to say the least.
- Nervous and stressed.
- Focused on the content mostly, I think the lead up was the worst part. As soon as I knew what I was working with and that I could do most of it, much of my stress evaporated. It did distress me that the exam seemed quite a bit longer and in some places more difficult than previous years, I suppose because the professors thought having the summer to study was too easy.
- I was appalled by the amount of memorization required. In particular, the Day 2 PDE problem was on the spherical Laplacian and the spherical Laplacian formula was not provided. This was particularly egregious given that the exams in the associated PDE module were open-book. I also recall some questions requiring us to know the names of particular theorems even though such knowledge was explicitly stated to be unimportant in class (we were told to understand the theorems not memorize their names). All in all the amount of memorization required seemed like artificial difficulty and incongruent with course assessments (my undergrad PDE module even provided a formula sheet for the final exam).
- I felt hungry, a little sleep deprived, and anxious.
- There were definitely moments during the exam where I panicked and thought about how I might fail the exam. This definitely affected my performance. I generally consider myself to be a good test taker, and this was my first experience where I had these types of thoughts during an exam.
- Nervous
- Like any other exam, focused and anxious to complete good work in the allotted time.

- I felt surprisingly at ease, due to my newfound apathy described in my previous response.
- I was very stressed at first, but eventually calmed down.
- A bit stressful.
- It is fine. There is a lot of time so it is not stressful.
- Again, stressed and exhausted. Also had a mini panic attack while trying to work through a question I felt ill prepared for.
- fine. i had studied a lot so i knew the stuff
- extremely panicked while being absolutely exhausted from nonstop studying for 2 months straight on top of doing research which is, in my opinion, more important than quals, so I refused to delay research progress because of APAM's extraordinary quals exams and suffered for it by being exhausted all the time. I did take two full weeks off of research to study full time and still felt exhausted and behind as if i was "catching up" compared to others in my cohort. Thanks APAM!
- During the actual exam it was fine, but the period on the first day when the exam was still printing (because the department was late and a mess) and Mike was telling us about all the ways it had gone wrong in the past was particularly painful.
- It was a rollercoaster, at time i felt like was definitely going to fail, but then i got lucky on the second day in terms of which questions were asked, and i ended up doing well enough to pass.
- Fine. But the fact it started 30 minutes late on day 1 is a joke, and so too for starting late on day 2. That the department could be so unprofessional in the administering of such an important exam baffles me. We spent months as students preparing, surely the department could have printed everything and sorted it out on time and had this most important of exams for us start on the dot at 10am.
- Normal.

8.5 Mental health quotes on studying for the oral exam

8.5.1 Applied Math

Responses to "How did you feel mentally and physically during your preparation leading to the oral exam?"

- I was a nervous mostly because the bounds of the possible questions were left pretty vague, whether intentionally or not.
- Very little stressed.
- I was extremely anxious throughout the process up to the examination.

- I was anxious, but mostly because my scheduling was a bit last minute - I was informed of the date 2 weeks prior to taking the orals.
- I felt ok
- fine. it wasn't nearly as stressful as the prep for written quals.

Responses to "How did you feel mentally and physically during the oral exam?"

- Shaking a little (but that's just me when talking in public sometimes) and nervous. Made some very silly mistakes as a result, but my committee seemed to understand, I think.
- I felt confident in presenting my research and answering questions.
- I felt panicked
- Honestly better than I expected, especially toward the end. While I was nervous at first it was a fairly relaxed environment and I was able to have rewarding discussions and articulate myself fairly well. The only main point of stress was the deliberation at the end where I was sent out to await news of if I passed.
- Nervous and excited
- fine. note that for the next question, i think it depends on the advisor.

8.5.2 Applied Physics (Solid State / Optical)

Responses to "How did you feel mentally and physically during your preparation leading to the oral exam?"

- I feel that it is fine.
- Fine
- I enjoyed it. I built a more solid understanding of the fundamentals of my field while I was preparing for the exam. I am not sure if I would have devoted this much time to just studying the fundamentals if it weren't for the exam.
- Pretty stressed.
- Felt OK

Responses to "How did you feel mentally and physically during the oral exam?"

- It is fine. The questions are not hard and the committees are firendly.
- I personally found the experience of taking orals over zoom very frustrating, I think it posed lots of small barriers which impeded performance.
- I felt a little nervous, but with encouragement from my committee and a few corrections when I messed up, I felt I was able to show my understanding of the material well and felt proud of my accomplishments.
- Pretty stressed.
- Felt OK

8.5.3 Plasma Physics

Responses to "How did you feel mentally and physically during your preparation leading to the oral exam?"

- It was not that stressful.
- Stressed
- I felt better and less stressed than before written quals. I wanted to do well the first time and didn't, which I didn't expect and which was disappointing. But I did not have existential, career ending fear like before written. I felt prepared for Orals, but I think this is another symptom of being at home, off campus, away from any other students I could prepare with. [identifying information redacted] the older students always seemed to be too busy, and I didn't get to know them well enough before COVID for them to commit time to helping me. I think that would have helped me understand what to expect on the exam and reorient my content preparation.
- The oral qual was much better than the written one, I felt much less pressure and stress
- Anxious
- Better than the written qual

Responses to "How did you feel mentally and physically during the oral exam?"

- I felt fine, the environment was relatively casual.
- I felt OK; at this point I had understood that being confident in your ability to explain your answer and yourself was necessary so I suppressed any anxiety/etc.
- I froze up and lost my mind when it became apparent it was not going nor would it go well. Content I knew and worked with every day became impossible to recall, that kind of thing. I wish circumstances around the exam in my particular case had been different.

- Fine
- Relatively relaxed with some flashes of anxiety
- Easier

8.5.4 Materials Science

Responses to "How did you feel mentally and physically during your preparation leading to the oral exam?"

- My biggest frustration about APAM is how difficult it has been for me to find an 'sense of belonging' here. There are a few reasons for this, and the demographics of the department are a big factor. One small thing that did not particularly help was the oral exam. It was not intuitive to me what was the purpose of that exam, and no faculty offered much of an explanation. I was just not convinced that it's productive to have another arbitrary gatekeeping exam/ academic hazing event well into second or third year. If the department feels they need the oral exam to have a mechanism to get rid of under-performing second or third year students, make it about research progress. That would actually make sense. And if they feel that the written qual is not sufficient by itself, maybe it's worth considering how to improve it.
- Very stressful and not very useful. I almost review the written exam material again. The first time reviewing it is probably ok, the second time I am less and less difficult to focus. I feel everything is repeating.
- I was anxious, distracted, and nervous, but less than when I took the written exam.
- quite ok
- It was fine.
- Fine
- I felt fine. I studied hard for three weeks prior to the exam and my advisor gave me the time to do so. So it was good break from research.
- fine
- I got mentally unwell after being denounced by a faculty in the oral qual. Had to consult psychiatrist for insomnia and anxiety.
- Fine during the lead up to my first attempt which I unprepared for and failed. I focused more purely on topics and courses pertinent to my research and did more limited preparation overall. More stressed during second attempt despite having better expectations/understanding of the oral qual structure. Prepared more extensively by reviewing coursework and practicing solving problems from courses.

- I felt ok preparing for the oral exams since I had already passed the written exam, but I felt like it was a bit of a waste of time while I was studying for the oral quals. I needed to study to do well on them, but I felt like the oral exams in materials science are not testing you on anything different than the written quals and it felt very repetitive for no reason. It felt like the oral quals are just another exam that you need to pass as a way to artificially make the program seem 'rigorous', even though the exam does not benefit the students. I, and the rest of my cohort as far as I know, studied largely the same material as we did for the written exams except we didn't worry about quantitative calculations as much.
- Nervous, but overall good.
- The oral quals rehashed all of the trauma from the written quals as it required me to re-memorize everything I had learned for written quals for a one hour oral exam format on the same exact content. It felt like a completely redundant exam as we had already passed the courses, been tested on these concepts in written quals, so this would be the third formal exam I've taken on courses. I was envious of those in applied math / atmospheric that were being assessed on their research, which is clearly more relevant to ensuring progress in our doctoral thesis work than examining our coursework for a THIRD time (finals + written + oral)

Responses to "How did you feel mentally and physically during the oral exam?"

- nervous, but professors are very kind
- I am very stressful. I remember I can barely draw a straight line when I was drawing the box for the lattice.
- Just bad, I was honestly putting up a front of 'calmness' and feeling uncomfortable around one of the professors in general. To say I felt like they had any accurate idea of my experiences and work in the past work would be impossible. I felt honestly looked down on for not sufficiently recalling what they consider fundamental material, which is largely un-applicable to the work I did for the past two years. I could feel their disappointment from the perception that what I did was supposed to be materials science directly relevant to their own work and classes, setting me up for failure from the start.
- A little bit nervous.
- quite ok
- It was fine.
- Fine
- A bit nervous initially but fine when it got going. The Professors were welcoming.
- fine

- optimism- puzzled- nervous- depressed
- Fine.
- Not great, the format makes it very stressful since if you can't answer a question you assume you'll fail the exam. Most of my cohort has independently mentioned that they very much thought they had failed after they finished the exam.
- N/A
- I felt super nervous and intimidated, and exhausted from studying trying to memorize every single major concept from all 6 courses to be able to recall them all at once during this exam. I took a full week from lab research to study full time. I felt absolutely inadequate and exhausted after. Yes I passed, but the suffering to get there was absolutely unacceptable and unnecessary.

8.6 Comments on self-studying

Responses to "Did you self study any quals questions instead of taking the class? If so, why?"

- Found better study materials on internet
- I already have a MS before entering the program
- I had taken the classes already.
- I learned from the textbook by myself instead of taking the linear algebra class because I thought this would give me more time for research.
- I self studied laser physics because there were five quals courses in the fall i felt i needed to take, but i was only allowed to take four courses. I needed to choose one course to self study so i chose laser physics, based on scheduling logistics.
- I self studied linear algebra because I didn't want to sacrifice on research time to take a class that is irrelevant to my degree program and I already took in undergrad. I think every math/physics/materials undergrad takes linear algebra so why would you require this for non math phds.
- I self studied the quantum question as I took QM in the Physics department. I also self studied the "optics" question because it was from "lightwave devices", which I was told not to enroll in and attempts to contact the professor went unanswered
- I self-studied Linear Algebra because I could not fit the class into my schedule
- I studied for linear algebra and statistical mechanics on my own. For the first, I was told I wouldn't need to take the class for the question; for the second, I was overworked my first semester with 4 other classes and couldn't manage this one too.
- I took the classes

- Linear Algebra and Phonon. For LA I didn't have time to take the course. For Phonon the version I took wasn't taught by the professor who writes the qual question but I cannot retake the same course.
- Linear algebra because I was a TA for an undergrad linalg/diffeq course, also I geuniunely couldn't handle a 4th course either semester in addition to trying to find the proper group and get started with labwork at the same time. Also from several others, depending on who wrote the differential equation question for 2021, one semester of students did not even cover the material that was on the exam.
- Linear algebra because I was the TA for that class.
- Linear algebra is not that frequently used in my reaserch
- Physics of fluids. There wasn't a fluids course being taught that year which didn't also have an engineering design component (which I didn't have time for) and I had taken a similar course in college.
- none of us took linear algebra; guess that's just because the questions are not graduate level.
- Physics of fluids. There wasn't a fluids course being taught that year which didn't also have an engineering design component (which I didn't have time for) and I had taken a similar course in college.
- Rather than retake a course I basically took in undergrad, I opted to take something new/more useful and self study.
- Self-studied one subject on the quals because with my limited number of registration points, I preferred taking a different class more aligned with my interests.
- Self-studied one subject on the quals because with my limited number of registration points, I preferred taking a different class more aligned with my interests.
- Yes, because I didn't have the time to take the course.
- Yes, because I have studied during undergraduate.

8.7 Comments on particular quals questions

8.7.1 Do you have any general complaints about pertinence of topics/classes required for the exam (e.g. being required to take certain math courses if in Plasma/Materials Science, etc.)

- YES. The Classical Mechanics course that is recommended for us to take took me an average of 15 hours a week outside of class during the spring semester (to get a B-) and the qualifying exam had a mechanics question that was from a chapter not even covered in the class. The people who passed the question were able to from experience in other classes or in undergrad, not from the class we were recommended by the

department to take. Getting tested on material that was not covered in the classes we were recommended to take happened for 2 questions on the general exam, something that could be easily solved by explicitly providing the relevant topics and textbook coverage for each class.

- Yes. Students, along with their first year advisors, should be able to determine on their own what topics/courses are best for them to take, and being forced to take a class to pass a question on the written qual that won't be relevant to them in the future seems unnecessary.
- yes, math is not that necessary since lots of materials science phds are not working on computation
- There are too many memorization to do, which does not reflect how we do research.
- The exam should be made open book.
- The statistical mechanics course was not relevant for solid-state and optical physics as it largely focused on polymers/chemistry. The question I was asked was also not based on the course material nor relevant to my discipline.
- Statistical mechanics and advanced mechanics were both interesting courses and i value what i learned in them, but neither course's material will be theoretically relevant to my research in nanophotonics, so i fundamentally disagree with the idea that my performance on such questions determines in part whether i am qualified to succeed in my phd.
- Seems silly that physics majors are graded against math majors on a math question - seems very unfair. Especially since math majors do not have to take a physics question. Not sure why we can't have more options of possible questions/classes we want to take.
- Quantum mechanics is not relevant to my field of study but I was required to take the question. The applied math classes were relevant.
- Plasma students were recommended to take classes like PDEs and Linear algebra when in reality we should have taken Complex Analysis because the entire field of Kinetic theory (a subject on which about half of Plasma II is based on) requires an understanding of complex differentiation, contour integrals, and residues. Most of us in the program had never taken such a class and therefore our understanding severely hindered in our field.
- Numerical Methods questions didn't match with the course material/homeworks.
- My primary complaint is that the classical mechanics and electrodynamics classes' curricula did not relate well to the corresponding questions on the qualifying exam.
- Linear algebra/PDEs should not be required for quals for non-math programs. All of us had to take one of these in undergrad anyway, and, believe it or not, we did not come to our program to study math, and if we did need to learn it, we would just take it as an elective class.

- In Classical Mechanics, the ratio of total content to the amount actually relevant to research in my program was quite large and given the amount of time that went into studying for that class, it seemed a bit much
- I would love more atmospheric science courses to be offered or required for those on the AM-atmos track
- I think the grad courses are not generally effective in communicating the core paradigms of MSE (ie Strucure-Processing-Properties-Performance) for the uninitiated, but for people with backgrounds in MSE, the program is really great to develop more theoretical and physically rigorous understanding of concepts which were learned more qualitatively as an undergrad.
- I think the coursework, since it defines so much of your first year in the program, should be more clearly discussed to potential incoming students. As a materials science student, I personally thought the classes I took were useful for my research but a lot of the classes are not necessarily useful for all materials scientists.
- I think actually math for plasma is super important. I think it's VERY unreasonable that certain questions' performance, outside your field, are weighted effectively heavier than others. Certain questions seem to be entirely determinative of your passing, outside your field, and others outside your field seem to not matter at all.
- I didn't have a problem with taking quantum as a plasma physicist since my undergrad was extremely quantum-focused and I as very well prepared, but I know that a lot of plasma physicists are not happy that we have to take a qual question on it. Honestly it doesn't really make any sense to make us take the class and then wait 5 months and spend tens of hours studying a subject just to pass a question then never see the material ever again.
- For materials, many of the topics are not actually relevant to my research
- For atmospheric science, proof-based linear algebra hasn't really come up a lot. It's definitely a fundamental building block to everything else, though, so I see the point.
- Depends on intent. Topics are fine if quals are meant to evaluate knowledge from a year of study at Columbia or from one's undergrad background. Particularly given the diverse nature of the department. However, if the intent of the qualifying exam is to evaluate ability to conduct research work and to the intent of the first year of studies is to prepare the student for that work then the qual structure and first year course structure need significant overhaul. Fewer courses, possibly spread over 1.5-2 years and more flexibility for students to focus courses on their research specialty would be a welcome change. Qualifying exams could be replaced with a examination that gives the student a research topic in a related field to their field of study and asks the student to develop a program of research for that given topic. I understand many other departments in US conduct such types of qualifying exams. Give the student a few weeks to conduct a literature review, propose a somewhat novel idea or set of ideas to

investigate pertinent to the assigned topic, have them present on the state of research in the field and require them to show and ability to translate fundamentals learned via their coursework to an understanding of fundamentals pertinent to the assigned research problem and outline and defend a program of research - simulation, design, fabrication, characterization or whatever is pertinent to the assigned research problem. In short make transform the qualifying exam into a miniature version of a thesis proposal for an assigned topic and have the examination carried out by the dissertation committee. This could also allow for oral and written exams to be combined into one qualifying exam. I understand this may be hard to implement and require changes to how admitted students are funded during their first year and when the join a research group but any changes that aim to make the quals and early years of study in APAM dedicated more towards developing good research skills pertinent to ones field of study would be welcome change over a current prioritization of a broad background of fundamental knowledge sometimes, but rarely, in fields not pertinent to a students actual research.

- Classical mechanics, at least as taught outside of APAM, is useless for the plasma curriculum/success in the field. Quantum mechanics is also essentially useless for success as researcher in this field.

- Advanced mechanics was one of my most interesting classes and the topic of the qual question was from a chapter that was never covered.

- Advanced mechanics and Statistical mechanics classes were not taught well enough

8.7.2 Should some "qual questions" (topics/required courses) be replaced with topics from other courses? If so, which and why?

- Yes, we don't need the silly day 1 material. It is generally very basic stuff which is made much harder by the professors writing the questions. Why aren't we tested on material that is solely related to what we will need during research. With that said, why are we only tested on fact based/right or wrong questions rather than more open ended questions which is more representative of research. I also believe you could add more electives or choices especially for those focusing in a special subset of their field and want to be tested on that.

- YES, from some electives that are more relevant to our eventual research, and in some cases additional questions from a few topics with some removed depending on our background/future

- Yes - some of the applied math courses should be replaced with atmospheric science courses for people on the AM-atmos track. Currently only 2/8 questions are on atmospheric science (the rest on applied math), when the relevant split should be closer to 50-50 in my opinion. Even if the extra atmospheric science courses aren't required, it would be nice if they were options for students on that track.

- We should get a Day 1 Complex Analysis question.

- There are two slightly overlapping numerical modules, maybe one of them should be replaced
- The questions for numerical methods and numerical PDEs are based on the theory and analysis while the course felt much more geared for coding aspect of it. I wish the courses placed greater emphasis on theory or separate numerical analysis courses were offered.
- The plasma physics students shouldn't have to take the quantum mechanics qual question, and it should be replaced with a more relevant topic.
- Phonons should not be required for quals or the degree as it is an extremely niche course that is rarely taught in any materials science program in the country. This should absolutely be an elective/non-required class. You could offer a different alternative question/class for some other MSE elective, e.g. for experimentalists. You already have two quals questions for crystallography, so the required knowledge seems quite arbitrary, just to have the same number of questions as the other programs.
- On the General exam students should be free to choose whichever questions. On the Specialty exam, I find the current format to work.
- Not sure how I feel about the stochastic analysis questions. It was not a topic most of us already knew very well – hard to cover.
- In my experience, quantum mechanics seems irrelevant to plasma physics, but for a degree in applied physics with a specialization in plasma, it does not seem inappropriate.
- If the structure of the quals stays the same, the division of material is fine, but you should make sure the questions being asked were actually taught/derived from the material covered in the corresponding classes....
- I think the applied math quals curriculum would benefit from having more analysis courses.
- I think quantum should be covered and that we should have to take it, but I think it might be better for us to spend time on maybe a thermo instead of a second EM, or instead of a quantum. It's difficult because there are enough topics we really need that 8 questions doesn't seem enough.
- i feel the intro to numerical methods and numerical pde in day 1 & 2 can be replaced by a numerical analysis topics. both courses focus a lot on the coding side but not really on the analysis side. coding is helpful for research but not really helpful for understanding some theoretical results.
- Complex variables are extremely important for plasma 2, and I did not take the course because there is no qual question for us on complex and I couldn't justify taking it considering how important passing the quals are. As a result I was extremely unprepared

for kinetic theory and fell behind pretty significantly, causing me to spend more time than I had studying prerequisite knowledge before I could even attempt understanding the actual physics.

- Classic Mech and QM could be replaced with just about anything else, for plasma students A thermodynamics class would be more pertinent to research in plasma physics than quantum mechanics.

8.8 Survey Responses

The unanalyzed survey summary here contains some "bonus" survey topics, including surveying students on whatthey think is the purpose of the doctoral program in general, the purpose of quals, distribution of students having advisor in APAM vs. external advisors, and their experiences with picking an advisor, which were not included in the main report for the sake of brevity.

Section 8.8: Survey questions and responses compiled by Google Forms

APAM Qualifying Exam Sentiment Survey

58 responses

Publish analytics

Which APAM subfield are you in?

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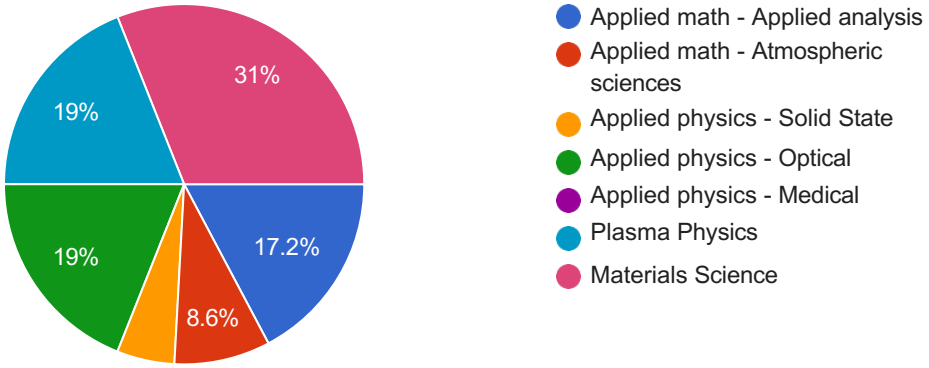
58 responses



What year PhD student are you?

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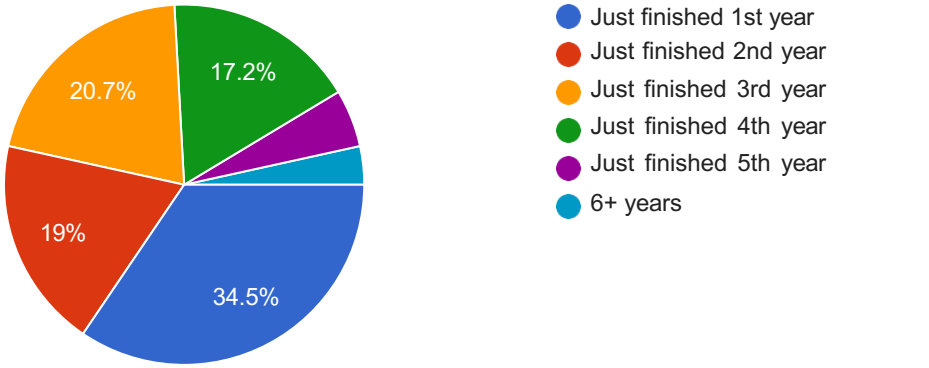
58 responses



Have you passed the written quals yet?

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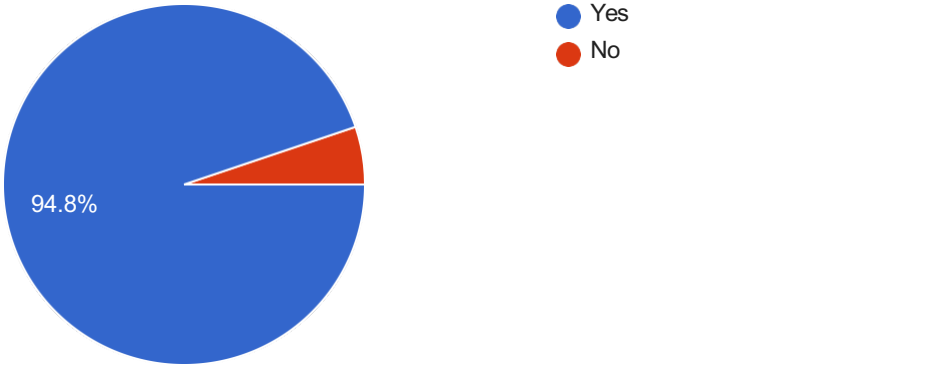

Have you passed your oral quals yet?

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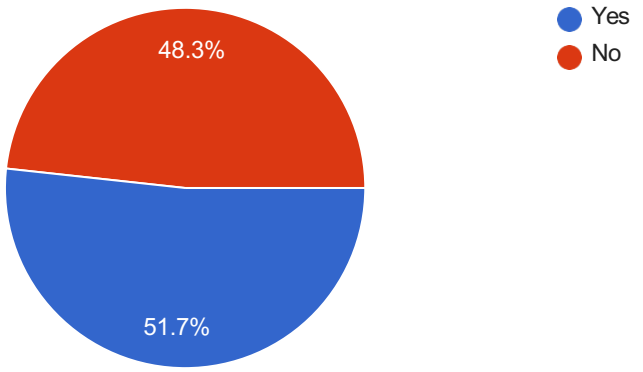

Have you passed your thesis proposal yet?

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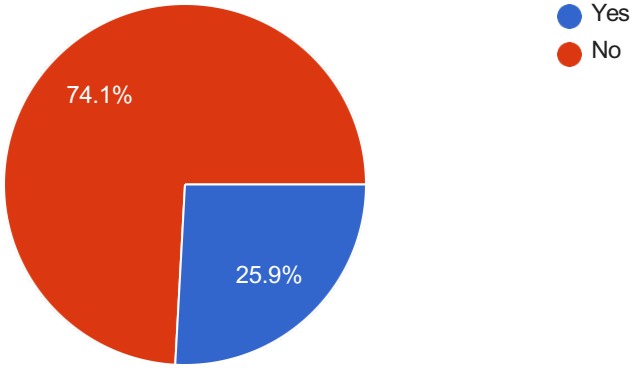
58 responses



Did you pass the written quals the first time you took it?

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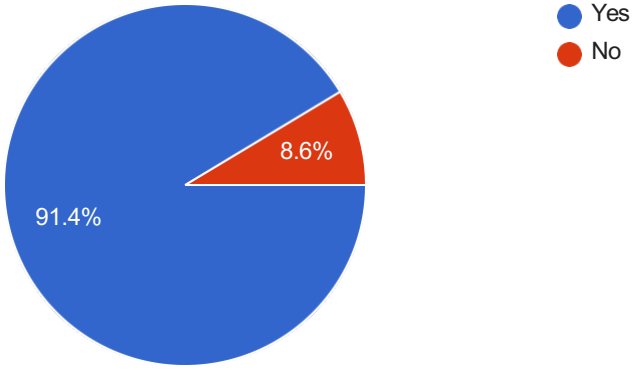

Did you pass the oral quals the first time you took it?

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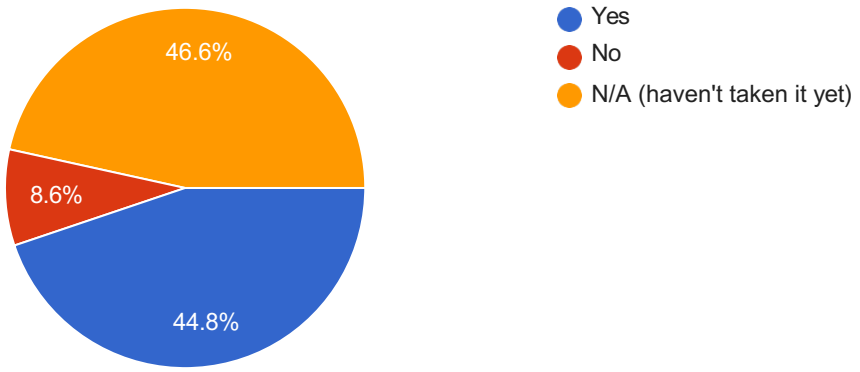

Did you pass the thesis proposal the first time you took it?

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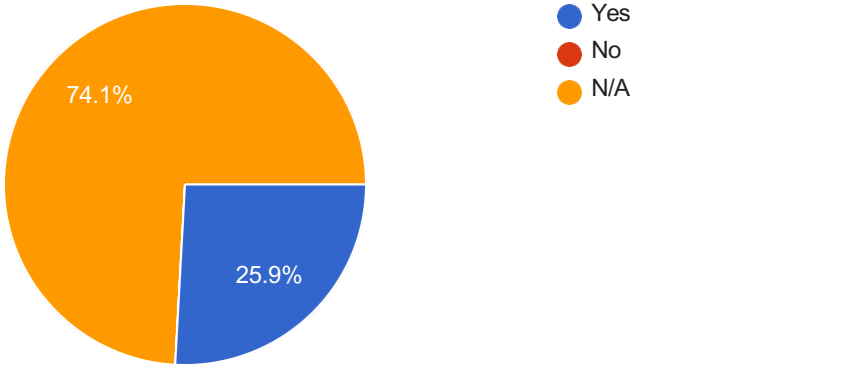
58 responses



Was the quals a consideration when you were choosing a graduate program?

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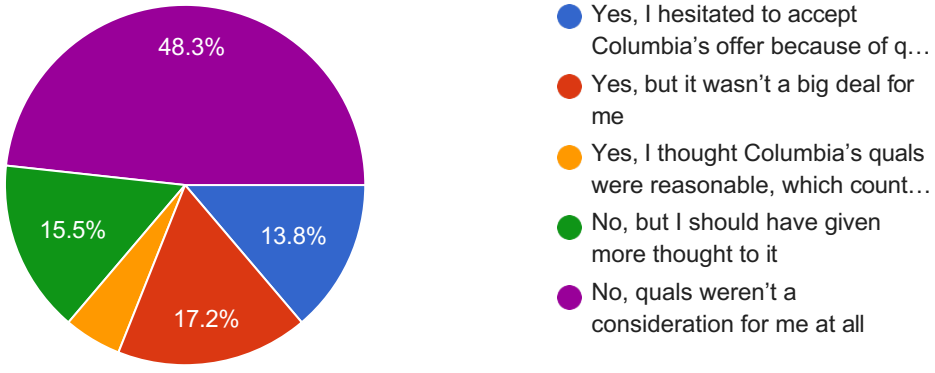
58 responses



If you've ever considered leaving the APAM program, were quals a consideration?

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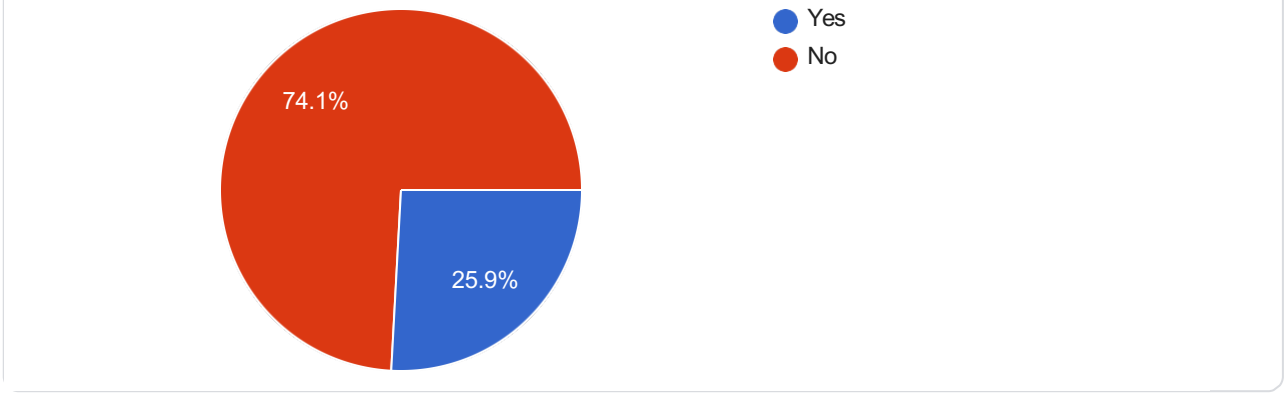
58 responses



7/28/22, 3:56 PM APAM Qualifying Exam Sentiment Survey

If yes, please explain, otherwise type N/A

58 responses

(written responses appendix of the report)

What do you hope to gain out of the PhD program?

Ranking system: 1: Strongly disagree, 5 strongly agree

To prepare me for faculty/academic position

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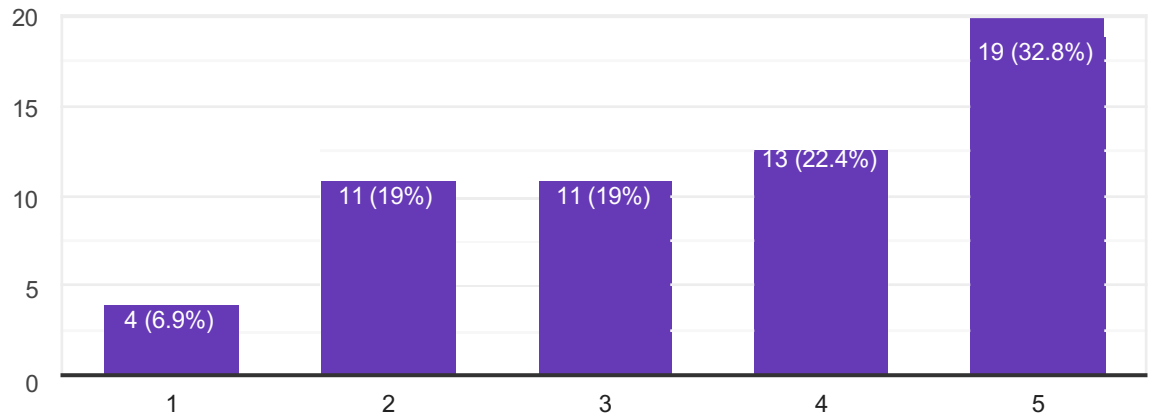
58 responses



To prepare me for a lecturer position

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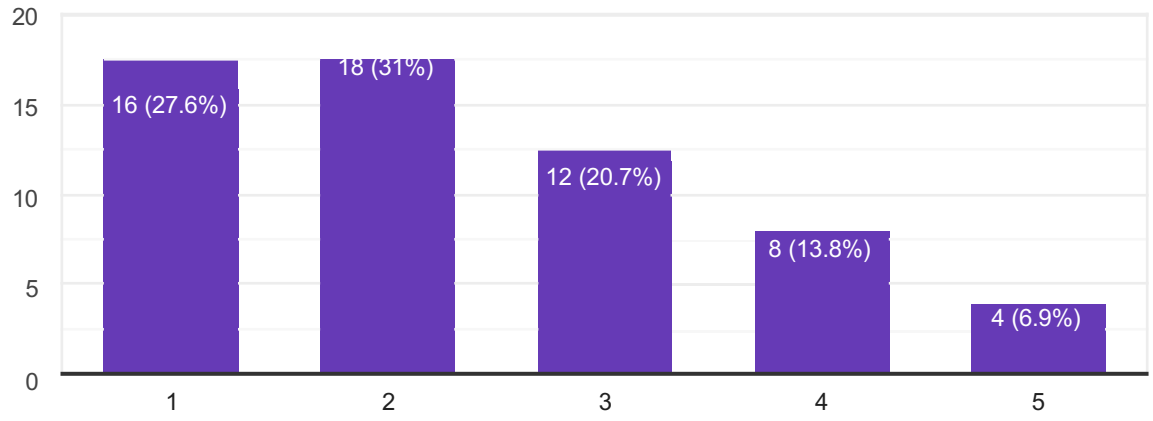
58 responses



To prepare me for non-academic research positions

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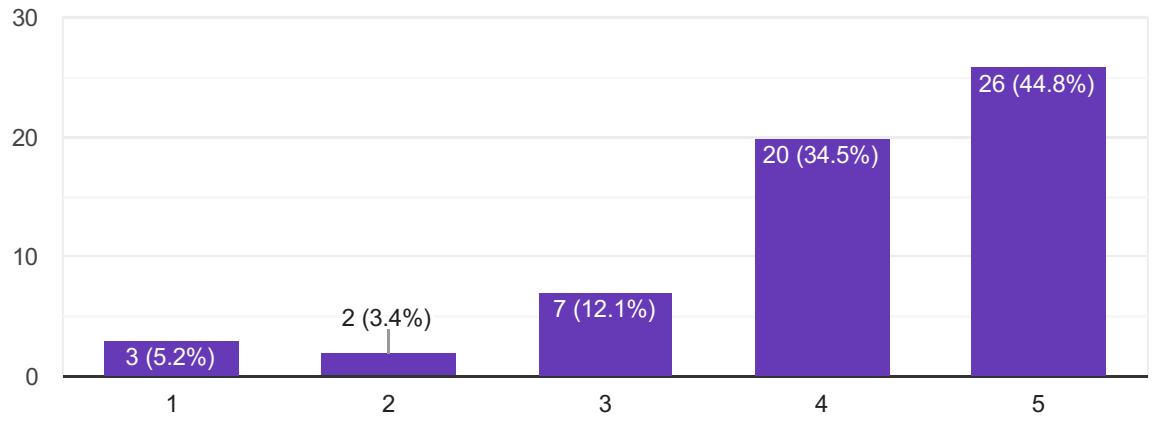
58 responses



To become an expert in my research specialty

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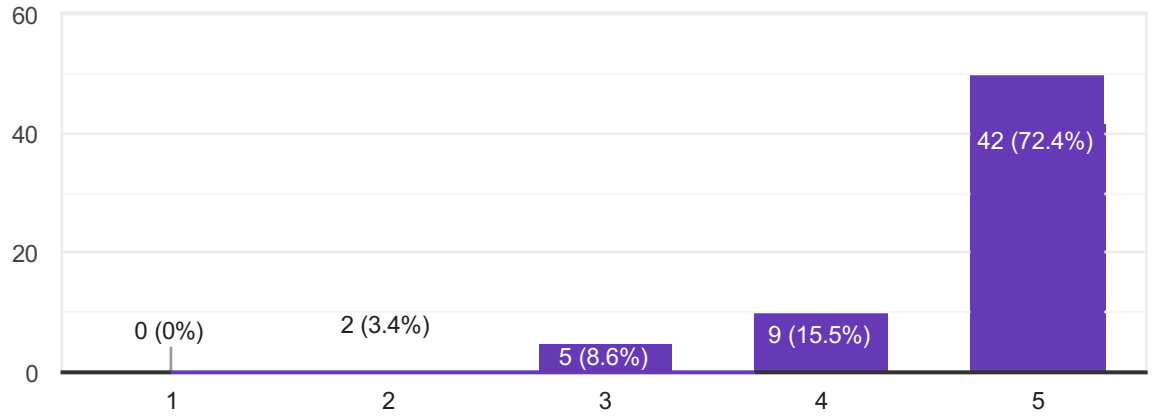
58 responses



To become an expert in the coursework for my program

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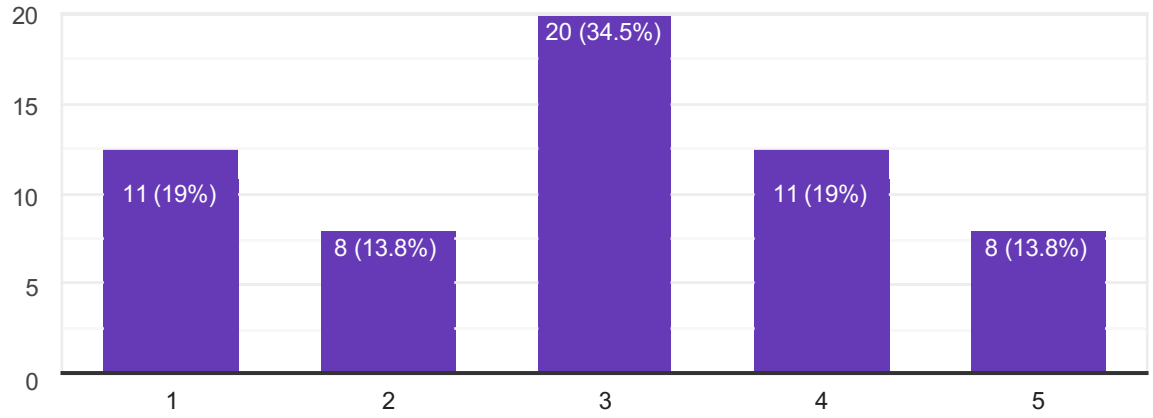
58 responses



If another purpose, please write in here.

4 responses

To learn for the sake of learning itself

To prepare me to approach new research problems and how to be a good researcher

I want to learn how to do effective research - I can pick up a textbook and learn coursework anytime. With that said, another purpose is to learn from great elective classes which would help with research (unlike first year courses which were all previously covered material)

To make our fields and often what seems rediculous or unfathomable, accessible to more who wish to pursue it

What do you think SHOULD be the purpose of qualifying exams in general for STEM PhD programs? **Ranking system: 1: least important, 5 most important**

To make sure PhD students have the fundamental knowledge needed to become a professional, independent scientist/mathematician in their discipline

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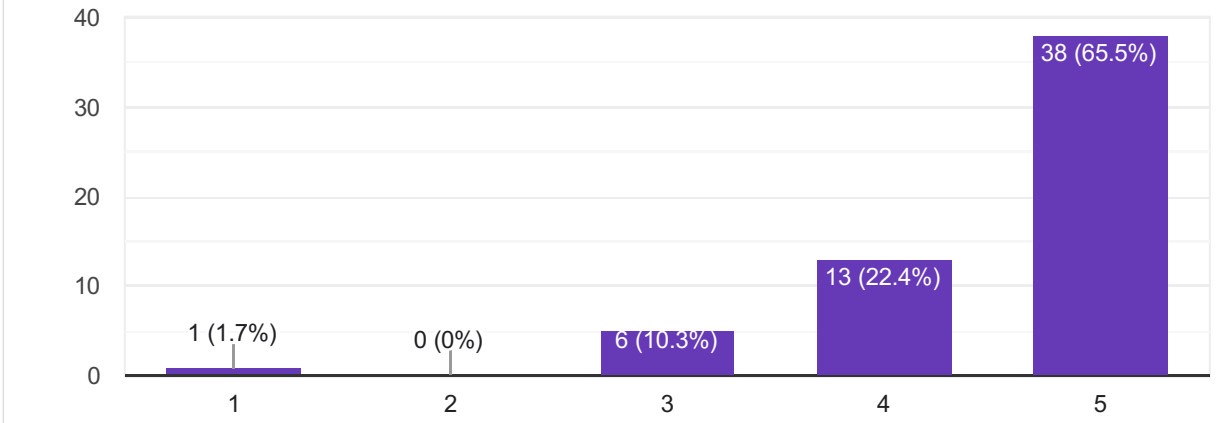
58 responses



To make sure PhD students have the basic skills to conduct independent research

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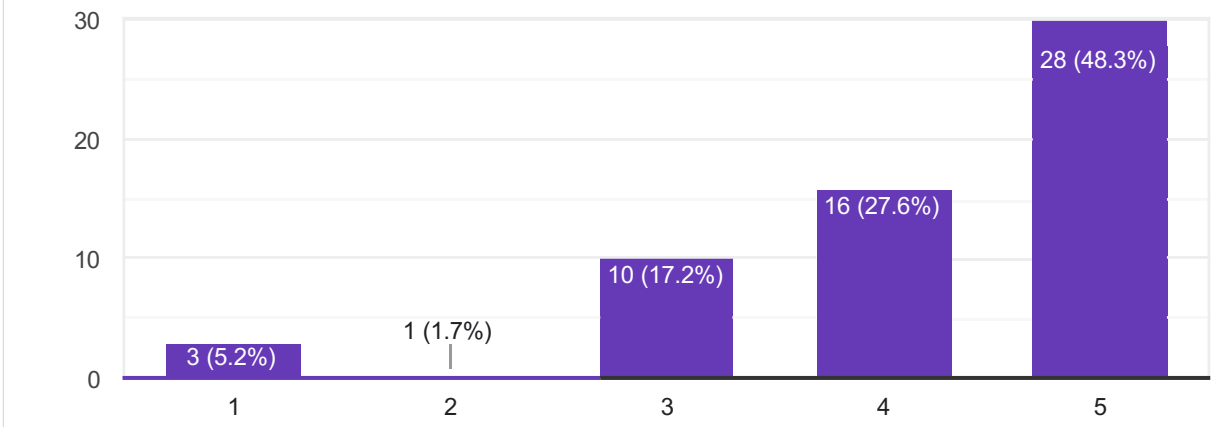

To see if PhD students can synthesize information from various contexts and apply them to complex scientific topics/contribute something new to their field

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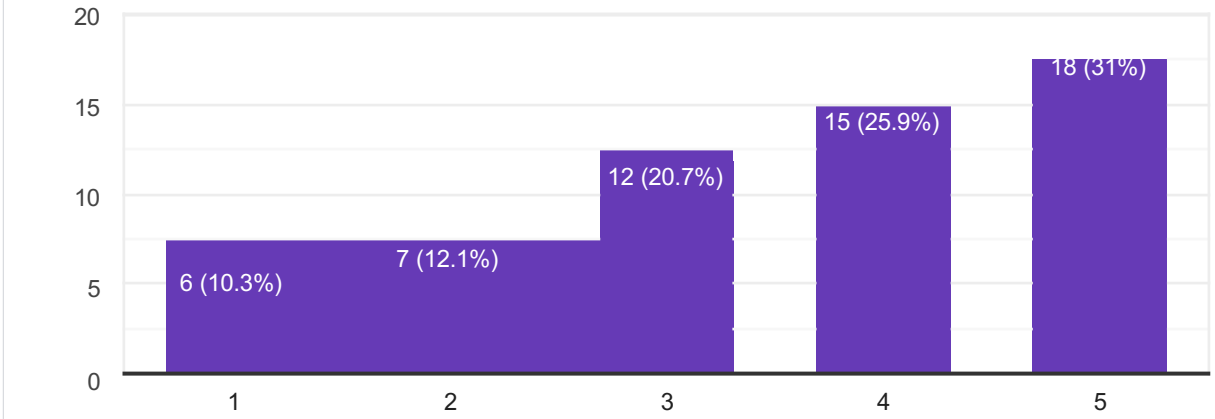

To see if PhD students can formulate meaningful scientific questions and develop and justify their strategies for answering these questions

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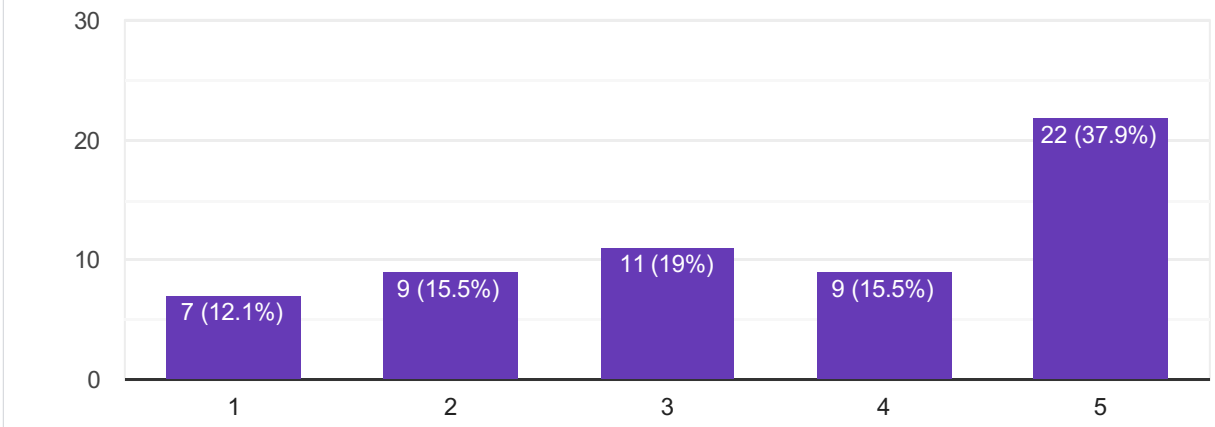
58 responses



To see if PhD students have the ability to write and present complex material logically and clearly

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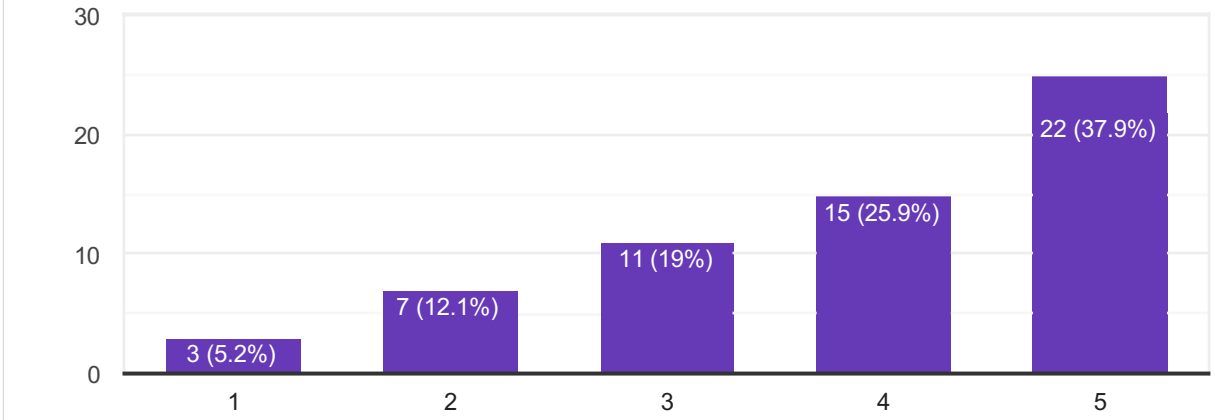

To see if PhD students have the ability to defend and extend their conclusions

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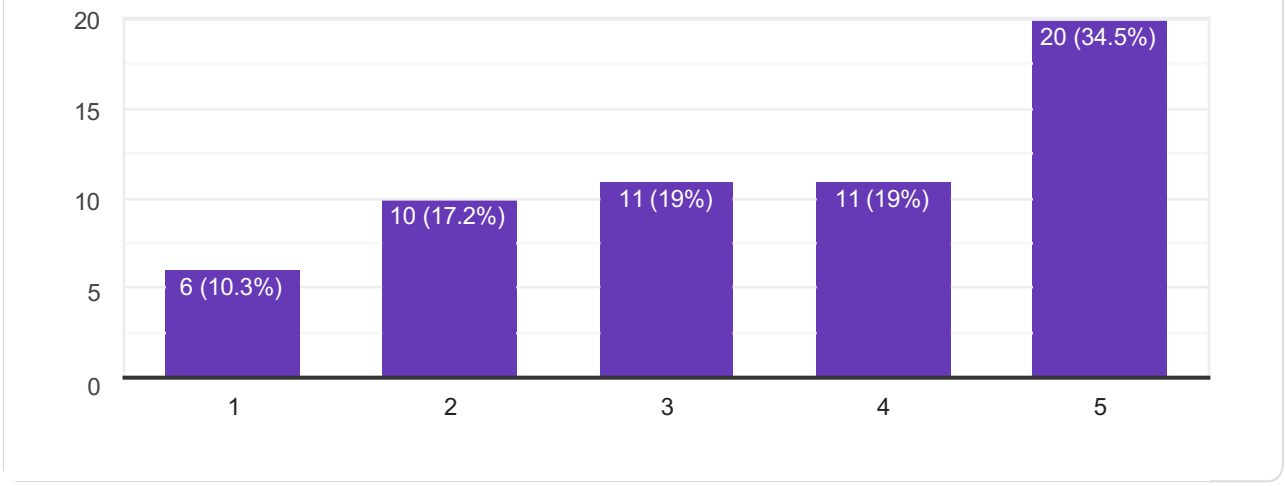
58 responses



If you think there are other purposes, please write in here.

13 responses

I think being part of a successful independent researcher is having a solid foundation of knowledge. But the qualifier, since it's just an exam, can't possibly test all the points above, and so I think it should continue to focus on being a test of knowledge

Including both oral and written in this portion of the questionnaire confuses the questions, especially since the oral exam varies a lot in its purpose among the APAM subdisciplines.

The act of studying for the qual is in and of itself useful, it teaches a certain independence, self guided work, and forces students to really confront and address gaps in their own knowlege

Sorry, just a general comment: A PhD student should have all these abilities once they have completed their PhD, but there seems to be a causality issue here. PhD programs should teach us these abilities. Testing whether we have them after only one or two years and then *kicking us out* if we don't instead of GIVING FEEDBACK and letting us develop these skills is frankly ridiculous. Qualifying exams should not only give feedback about the student, but also be analyzed for feedback about the department. Is the department successfully teaching students these skills?

The quals establish a rigor to the APAM programs. To be very honest, if my degree did not require quals I would think of it as being of a lower standard/quality. Particularly the general subject area portion of the written quals is important for ensuring a common base level of understanding among graduate students. Finally, the act of studying does a service to graduate students by aiding in retention of the material tested. Without the quals I think many of us would be less motivated to retain either the general undergraduate-level subject matter or the material learned in the first year of coursework.

I do believe that being able to solve problems correctly and efficiently should also be included in the purposes - but not so primarily as is done now.

I feel the qualifying exams should just test the pure fundamental knowledge of the student's subject and test the student's ability to apply that knowledge to hard broad questions. Essentially a test of academic skill and agility. The thesis proposal etc then tests questions related to creativity in forming new ideas/directions from existing science.

Quals should be a way to measure progress and identify weak points in a student’s knowledge-base, but should be de-emphasized as a weed-out process. What is asked on the exam in its current form is, by necessity, very narrow in scope. Perhaps, after a failed question, a student can attempt a make-up with an oral exam on that topic. Also, quals should NOT be a black-box; the scoring and what constitutes passing is very opaque, which heightens everyone’s nerves because its not clear what you have to do to “Pass.” The purpose (of an exam in its current format) should be to give students an opportunity to revisit and strengthen points that they found challenging and were weak on in the courses, but ultimately they already passed the

courses, and so I think the qualifying exam can serve a role as a measure of progress, and to identify weak points (perhaps a student could even be required to retake a class if they do really poorly on a given question, and cannot otherwise demonstrate competency in the area) but I am not sure if it is effective to use it to weed students out of the program. Getting a PhD is hard as it is, and the realities of research and the student's advisor should determine if someone ultimately continues far enough to write their thesis and graduate.

Qualifying exams should try to evaluate a students preparedness for the rigors and challenges of actual research work, including some of the more mundane challenges and coursework in the first year should be aimed at helping students towards this end not just trying to establish a sound base of fundamentals in their field and evaluating the students on how much they learned in that year of courses or retained from their undergraduate studies. In my experience fundamentals, particularity in ones research specialty can be learned and often are learned better through actual research experience than through coursework.

NOT to repeat what classroom exams already do

To prepare phd students for the transition to being an independent researcher in their field

Most generally, to assess one's ability to meaningfully participate in their field of study

How did you prepare for the written exam?

Working on previous quals questions

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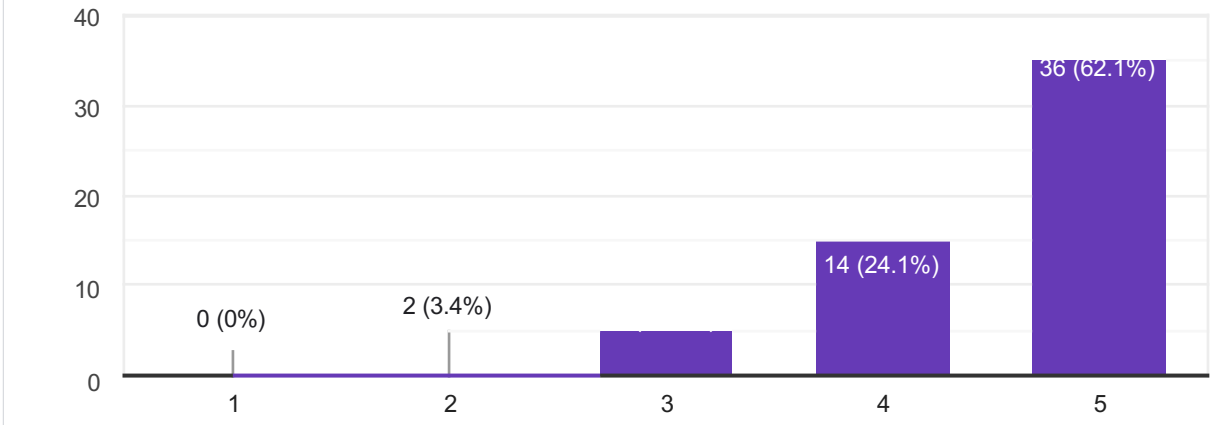
58 responses



Reading/studying content from courses (homeworks, finals, etc.)

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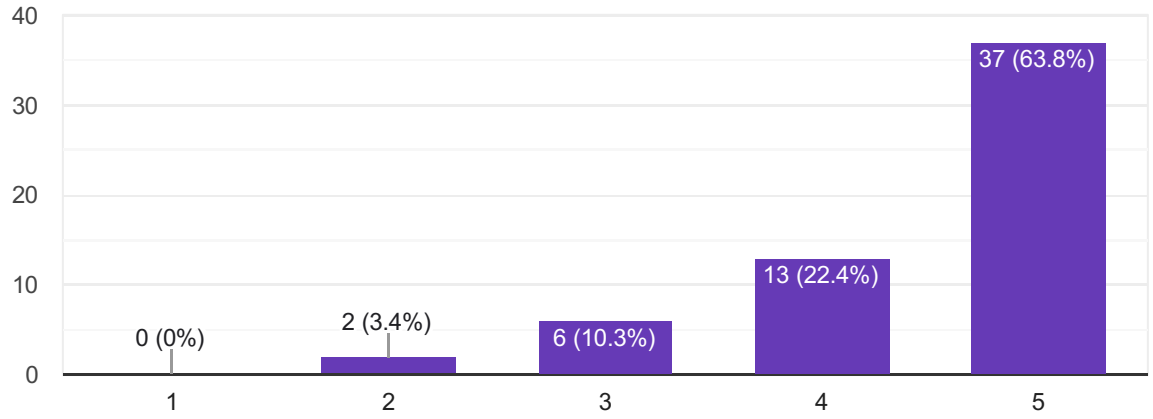
58 responses



Mostly reading/studying content on textbooks

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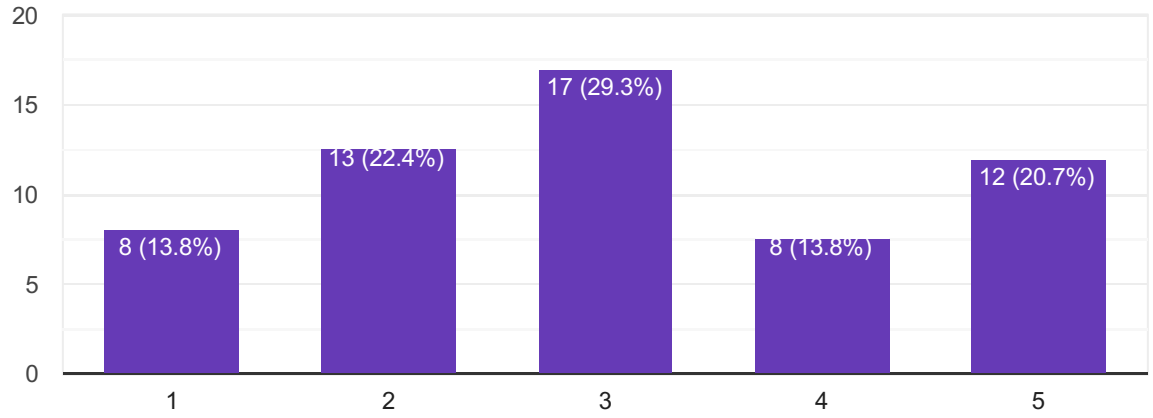

If you prepared some other way, please specify

10 responses

Flashcards, writing up solutions to old quals

Practicing timed questions and remembering formulas to be better at test-taking

Group study

Watching YouTube lectures from other programs, e.g. MIT Open Courseware

I started reading material of a textbook which was unrelated to the course I took because I was worried that the qualifying exam question might cover this information. In fact, I was correct and the exam did cover this material. However, this was a complete guess! It also took away from valuable time that I needed to study other important information.

Reading/studying homeworks and exams from classes I took

Work with members of my cohort, especially for orals writing questions for one another

For the written, working and discussing the material with other members of my cohort. For oral, isolated studying, which wasn't the best

Study with a group

Writing toy programs/scripts in things like Mathematica to check understanding

Written exam Feedback Continued

Who did you study with?

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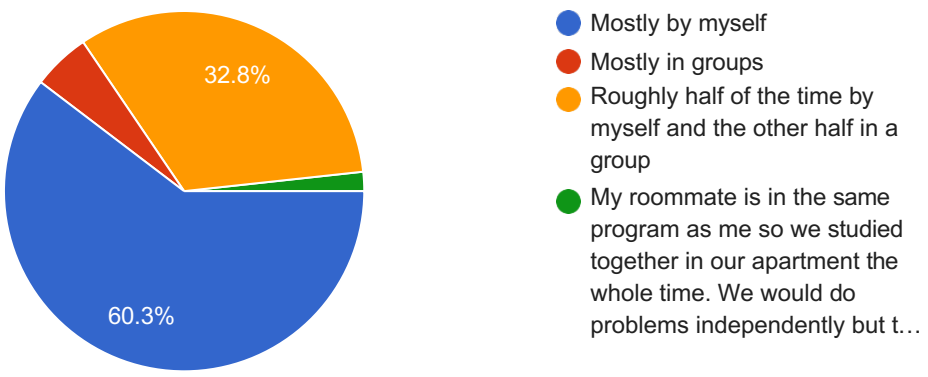
58 responses



How many hours did you spend per week studying for quals on average DURING winter break before quals?

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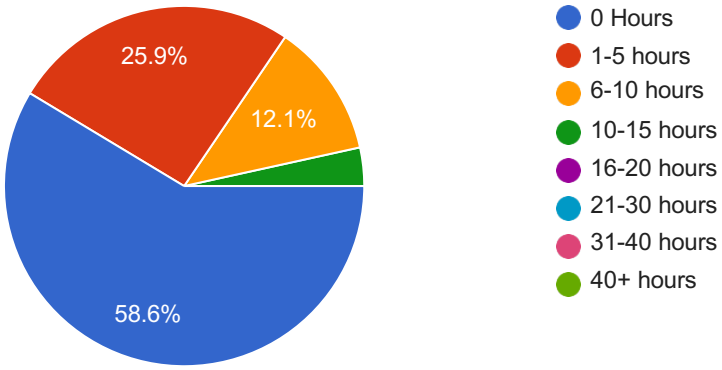
58 responses



How many hours did you spend studying for quals per week on average BEFORE spring break?

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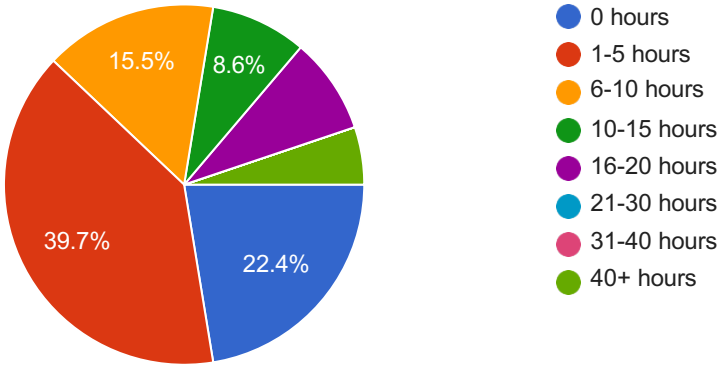

How many hours did you spend studying for quals per week on average AFTER spring break but before the last week before the exam?

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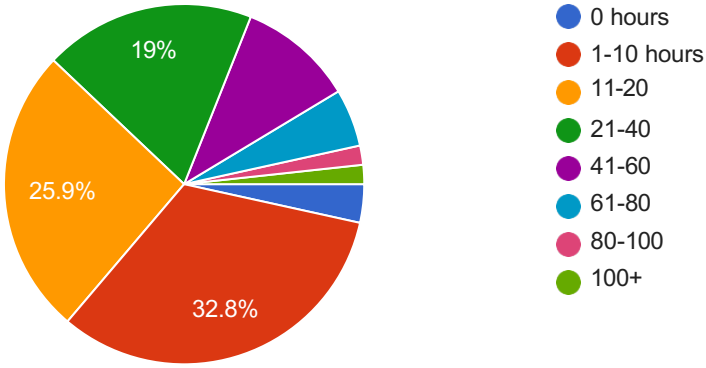
58 responses



How many hours did you spend studying for quals the last week leading up to quals?

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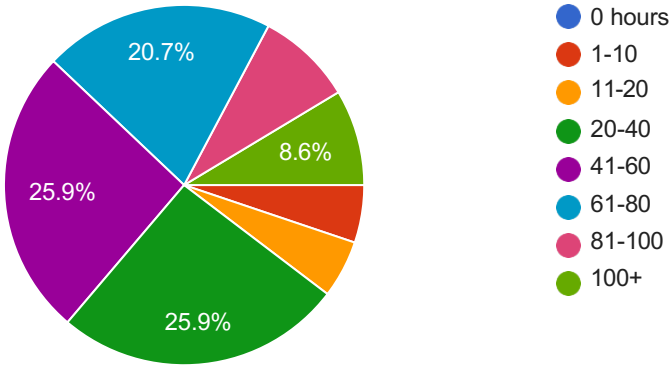
58 responses



Do you think written quals were effective for you to review undergrad material?

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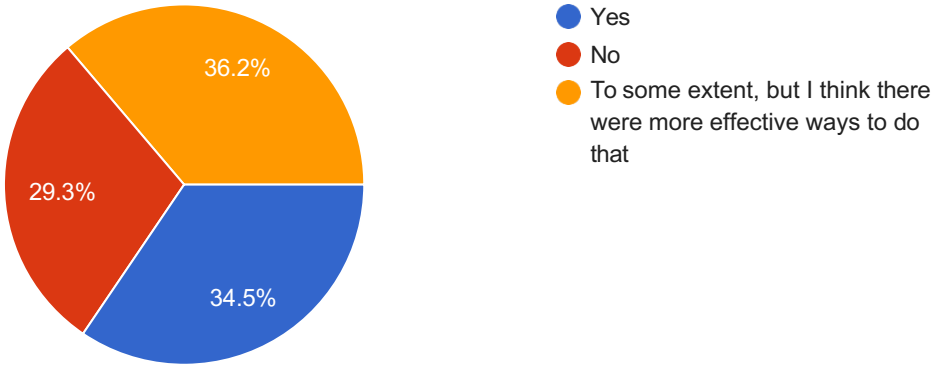
58 responses



Do you think written quals were effective for you to review graduate material?

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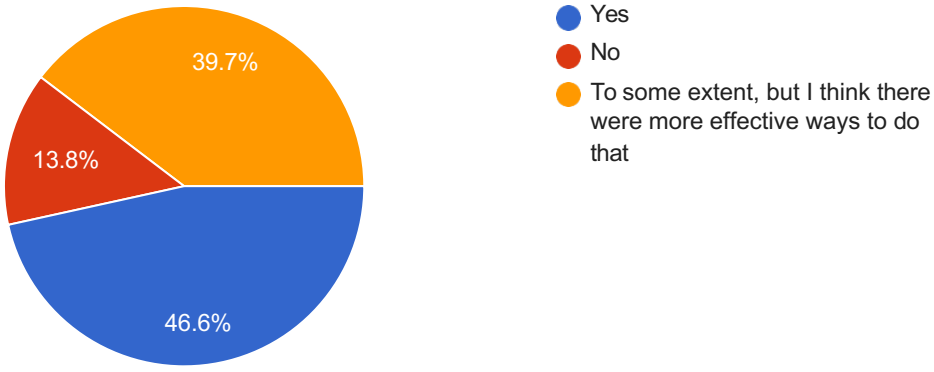
58 responses



(ONLY answer this if you've completed AT LEAST 2 years in APAM) Do you think written quals were effective to prepare you for your PhD research?

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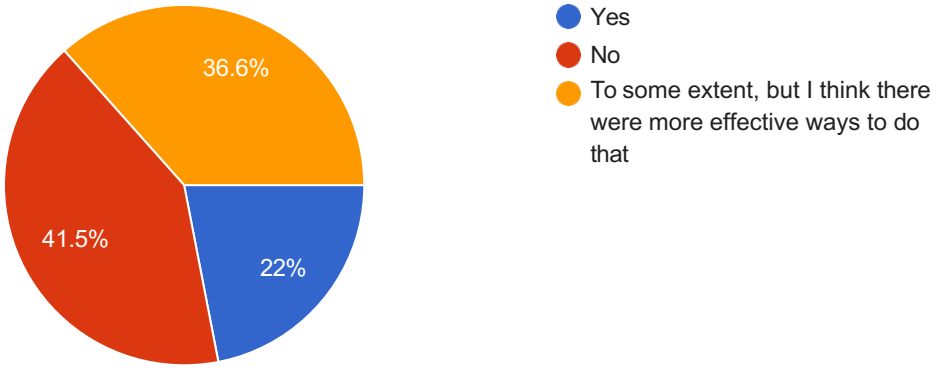
41 responses



Written responses to the following questions provided in the report appendix.

Did you self study any quals questions instead of taking the class? If so, why?

58 responses

Do you have any general complaints about pertinence of topics/classes required for the exam (e.g. being required to take certain math courses if in Plasma/Materials Science, etc.)?

34 responses

Should some "qual questions" (topics/required courses) be replaced with topics from other courses? If so, which and why?

28 responses

How did you feel mentally and physically during your preparation leading to the written exam? Please elaborate on any factors that could have made quals more difficult for you, if you felt prepared, or whether you sought counseling or medical help during the process as long as you feel comfortable sharing this type of information. If you want to share your experience with it, but don't want your words shared with the APAM faculty, please state that and we will honor your request.

58 responses

How did you feel mentally and physically while taking the written exam?

58 responses

Do you think we should keep written quals the way they are currently?

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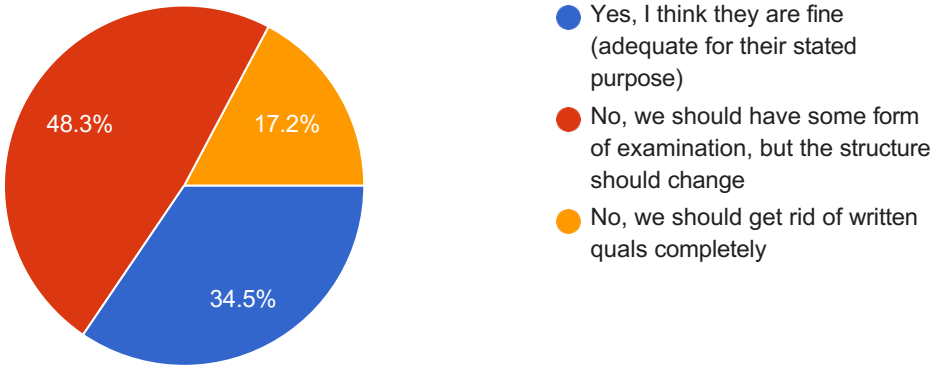
58 responses



If you haven't taken the oral exams yet, please state any concerns about the format here.

14 responses

They seem a lot calmer and the older grad students are pretty chill about them so I don't really have any concerns but I don't really know much about the format

None. I hear it's easier than the quals.

In my area oral quals seem to be based mostly on what I've done in research and background knowledge needed to move further in research, which I think is important/fine, and I feel that the more individual format allows me to work with my committee to understand what I need to know to pass, which lowers the stress. I believe this isn't the case for all areas of APAM though.

They seem too late in the degree to be necessary as a general exam

I don't really know much about it.

I feel like I don't have enough information about oral exams to really formulate concerns about them, which is a problem in itself...

I don't know anything about the oral exam, but if it's anything like the written exam, I imagine I won't be particularly fond of it.

I have not yet taken the oral exam, though my main concern in preparing is the ambiguity surrounding the examination. I understand the overall purpose, as well as the need to keep certain details discrete, but overall the details of the oral seem less clear than the written exam, which can make preparing adequately more difficult.

I don't think oral exam is necessary as we already have writtem exam and proposal exam.

I have not been told anything about how the oral exams will be like

Well first it hasn’t been made clear to me the format (which is a concern). I have heard that the process is completely variable depending on who is in the committee going from joking easy to incomprehensibly difficult. I am not sure what material could be covered even.

Also, why can’t you just do a paper presentation or research presentation like most other programs? Again, this tests real research ability. No one is going to ask random facts, but we do need to be able to know how to present at a conference.

I have a concern about preparation more so than format. While the quals helped me master my course material I did not feel they prepared me to transition into research, in fact the time I

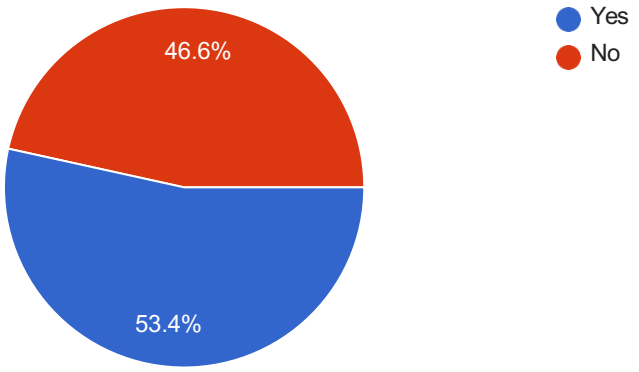
spent preparing took away from time I could have spent getting started on research/ exploring different topics.

My concern about MSE oral exams is that neither my advisor or I cannot have any input on the members in the committee members. As far as I know, in other division of APAM the advisor are required to be the committee member. I don't know why MSE has this "unique" practice in the whole department and it's very unfair.

i have no idea on the format of the oral. so no concern currently.

Have you taken the oral exam? (if no, you'll skip this feedback section) Copy

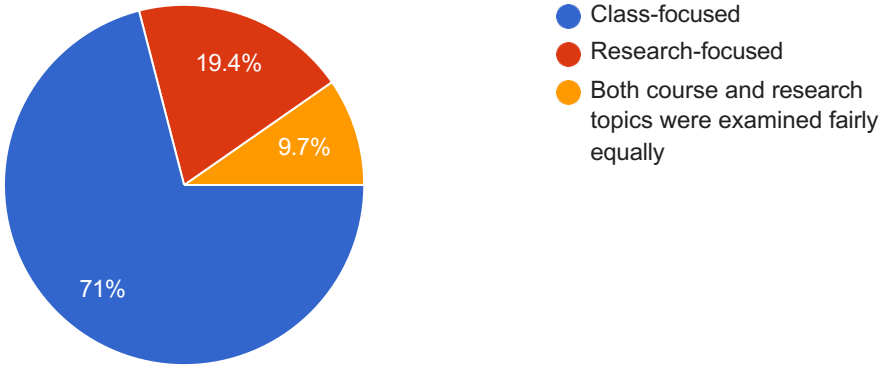
58 responses



Oral quals feedback continued

Were the questions on your oral exam more class-focused or research focused? Copy

31 responses



Was your advisor present?

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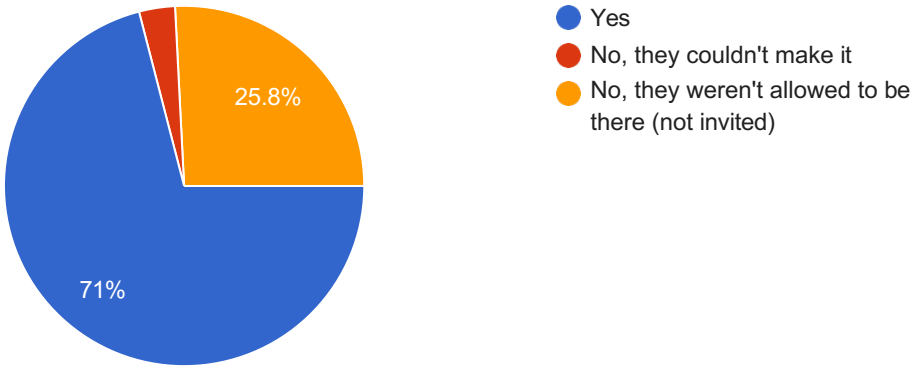
31 responses



Was your advisor allowed to ask questions?

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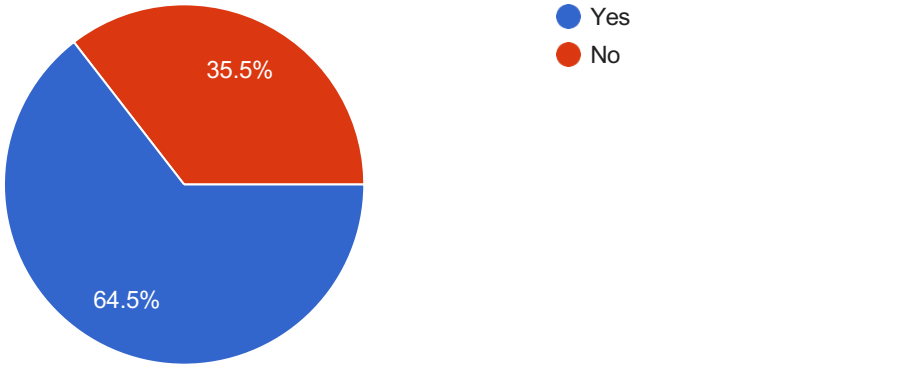
31 responses



Was your advisor allowed to pick the committee?

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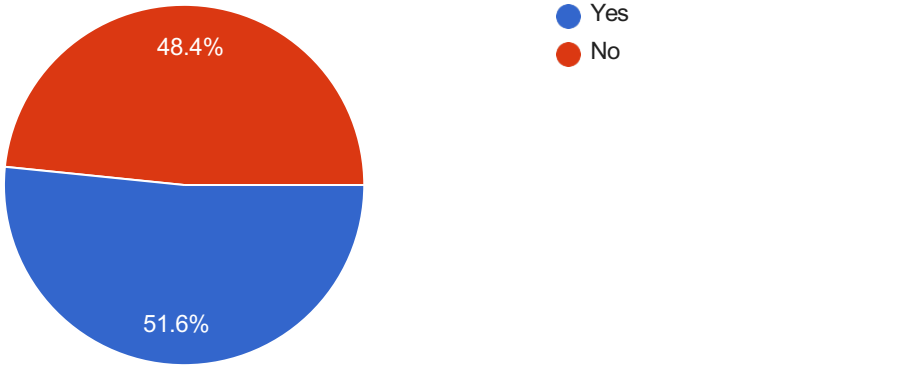
31 responses



Can you briefly describe the format of your oral exam? How many questions were you asked; were you able to discuss your thought process with your committee etc.?

31 responses

I was asked 5 questions. Yes, I am able to dicuss my thought.

My exam lasted an hour. I was instructed to prepare a 20-min or so brief on the theoretical material underlying my current research, with the understanding that I would be interrupted throughout to be asked questions. Questions ranged from simple understanding to being asked to work out examples to theoretical future research questions - thus ranged from answerable to unanswerable, and only able to provide initial thoughts. I was asked probably around a dozen separate questions, of different length, and the questioning lasted 30-35 minutes of the time. I was able to show my thought processes and have full discussions on research toward the end of the exam.

The three members of my committee rotated asking questions. Each question was extended, consisting of multiple follow-ups. The whole process was highly interactive, my committee members talked me through the question whenever I got stuck.

n/a

Each committee member asks a series of questions until the committee member is satisfied with the answers. You discuss your thought process during the process. If there's extra time they may ask more questions.

Committee member ask a question, I answer it. If I am answering it wrong or do not know the answer, the committee member will discuss with me, give me some hint... etc. Yes I am able to discuss my thought process.

several questions on the class. Try to speak out my logic and thoughts

Roughly three in depth questions, with 20 min for each, in front of a chalk board, with ample time to discuss my thought process or to be re-directed by the examiner if necessary

Over zoom, I was asked general matsci questions and to work through them on my shared IPad screen.

Maybe 10-15 questions total, questions lead into each other to tease out the concept being tested. I was able to discuss my thought process.

I was asked about 4 questions over an 1-1.5 hours by my committee of 3 professors. Each professor took turns asking fundamental questions from their courses, and I discussed my thoughts as I worked through them on a whiteboard.

Were asked questions from simple ones and followed with deeper questions. About 10 in total. No, pretty much they expect an accurate answer and a faculty stopped me whenever I describe thought process different from ‘correct’ one.

Roughly 3 questions, about 1 per committee member. I was able to discuss my thought process.

Something like 5-6 questions were asked, the committee took turns. If I struggled I would talk about what I knew/what I was thinking and they would help.

I discussed the thought process with 2 members only. Two questions from each of the committee members.

"Chalkboard" style exam where the profs asked me to solve problems in front of them for about an hour. I was asked about 6 different topics, and the committee would try to help if I was stuck or going the wrong direction.

Four processors asked me questions one by one. I need to show my work on the blackboard. There were many questions I was asked, I cannot remember the exact number. I was able to discuss with them.

I received many questions related to my research (more than a dozen). But it all felt like a conversation. I found the questions very helpful in thinking more deeply about the research and also identifying new research questions. The overall experience was very enjoyable.

I stood in front of a whiteboard for 1.5 hours while the three Professor's (representing five out of six of the core class's) asked questions associated with their classes/subjects and I had to answer them.

A brief presentation on my research up to that point, followed by about an 75 minutes of questions from the committee, ranging from my basic knowledge about my research topic to my perspective on where the research might be heading.

Zoom. Asked questions and answered with a tablet and pen via screen share. Lots of discussion and even a little hinting when iIgot stuck

zoom call <1 hour; i presented slides and a committee of three faculty asked questions. it felt more formal and I avoided talking about things i wasn't sure about or ongoing/incomplete thought processes.

At least one round of one question per person. My thought process was the main thing they wanted to hear.

One primary question from each committee member with smaller follow up questions. I could discuss my thought process, much better during my second attempt as I was better prepared. This exam was an odd experience for me as it was almost a lighter version of the written

quals. Most questions asked required solving problems directly on the whiteboard and not offering intuitive or qualitative answers. Their was more emphasis at least on justifying how I was solving a problem than would occur during a written exam and less requirement to completely solve a problem. This exam was purely coursework focused and had little to no overlap with my research work.

About 1-2 questions per class roughly. There was no real rhyme or rhythm to any of it, and it was the equivalent of doing the written exam in-person on a whiteboard without really any time to pause or think without feeling scrutinized (partly because of who was on my committee). They did try to guide me through things, but for course material, my thought process is generally scattered, which was not conducive to this exam.

About an hours worth of questions, and we talked about the design process of my future computational studies.

I just presented my research, and was asked a lot of questions, I was able to discuss my thought process.

I don't remember exactly how many questions were asked, it didn't go very well the first time (I froze up real bad) so I had a few follow up questions on another occasion. I was able to describe my thought process, I found it to be a fine process independent of my own performance. The content was all plasma, including diagnostics, MHD, kinetic theory, and a bit of experimental considerations, all of which we should be accountable for. I will say the guidance as to what to study could be improved.

Each committee member gave me one topic and a short series of questions, and they led me through the process of solving the questions

3 professors in the committee, each asked one question.

Mostly qualitative questions. No derivations. Not many material science questions.

How many hours per week, on average, during the 2 months leading up to this exam, did you spend preparing for the oral exam?

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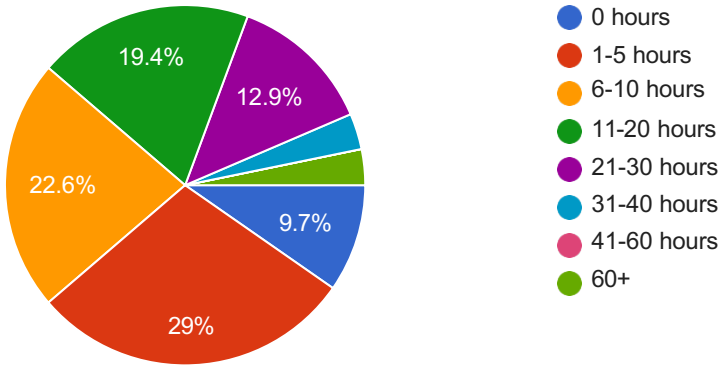
31 responses



How many hours per week, on average, during the 2 weeks before this exam, did you spend preparing for the oral exam?

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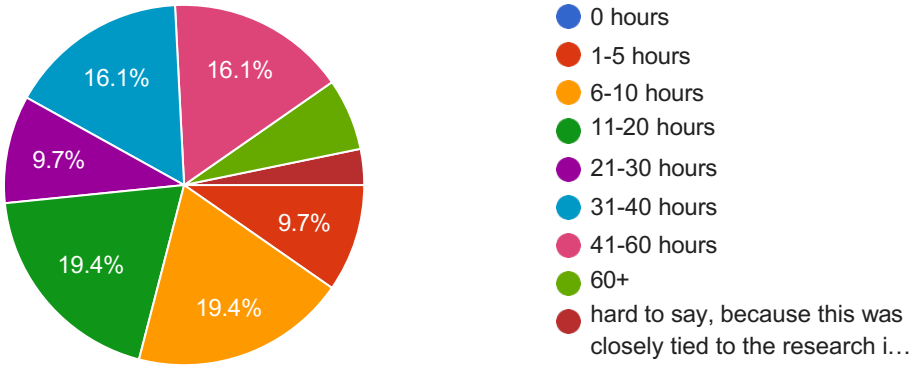
31 responses



How did you prepare for the oral exam?

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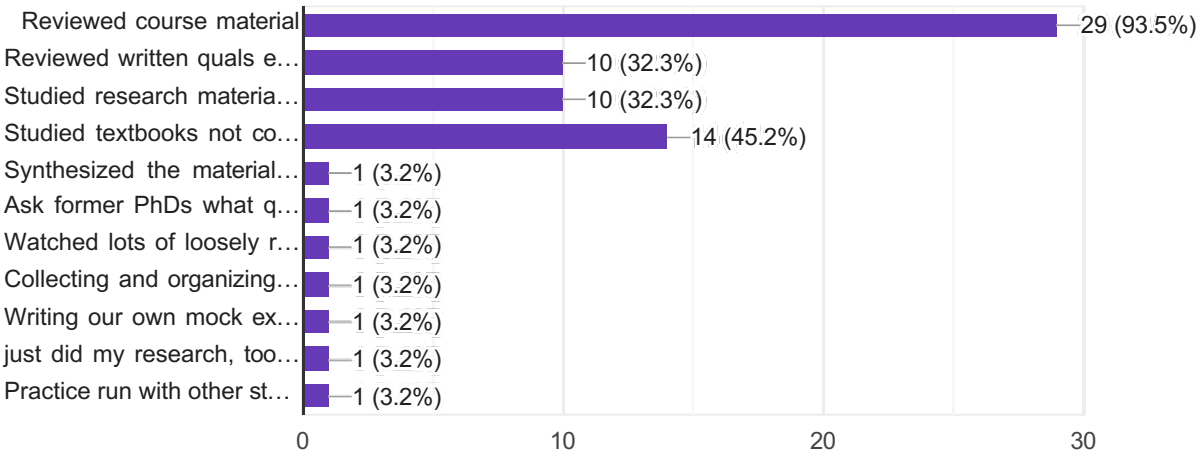
31 responses



Do you think the oral exam was effective for you to solidify your understanding of the fundamentals of your field?

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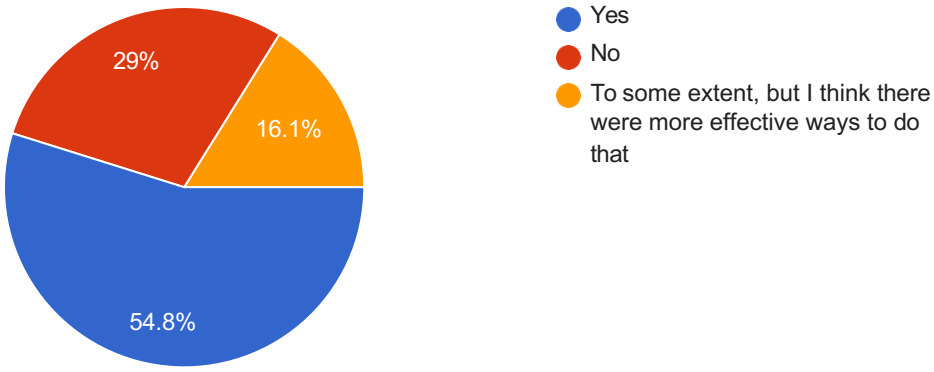
31 responses



(students that have completed 2 years+ only) Do you think oral quals were effective to prepare you for your PhD research?

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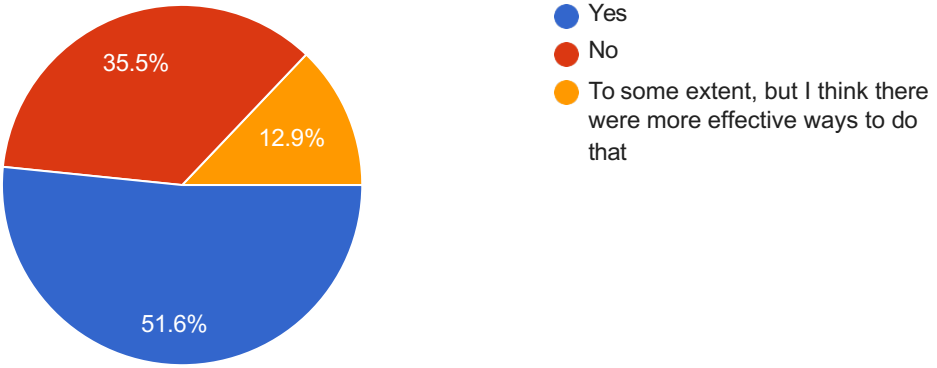
31 responses



These written responses are in the report appendix

How did you feel mentally and physically during your preparation leading to the oral exam? Please elaborate on any factors that could have made quals more difficult for you, if you felt prepared, or whether you sought counseling or medical help during the process as long as you feel comfortable sharing this type of information. If you want to share your experience with it, but don't want your words shared with the APAM faculty, please state that and we will honor your request.

31 responses

How did you feel mentally and physically while taking the oral exam?

31 responses

Do you think we should keep oral quals the way they are currently?

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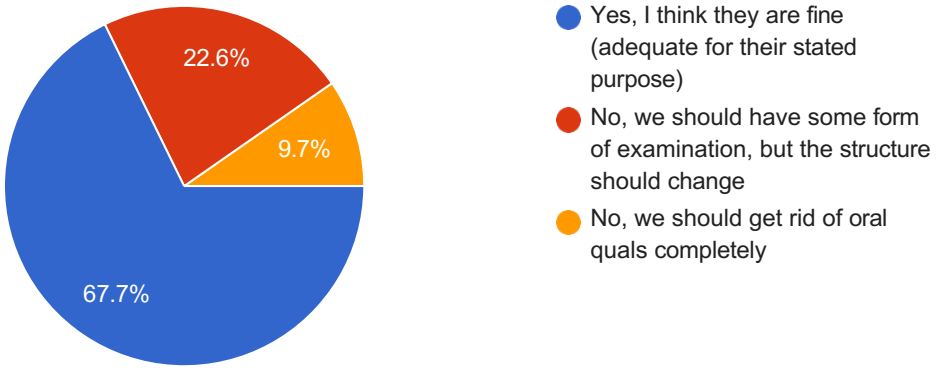
31 responses



Finding an advisor and starting research: what was most important to you when choosing an advisor?

Ranking: 1: least important, 5: most important

Their specific research specialty

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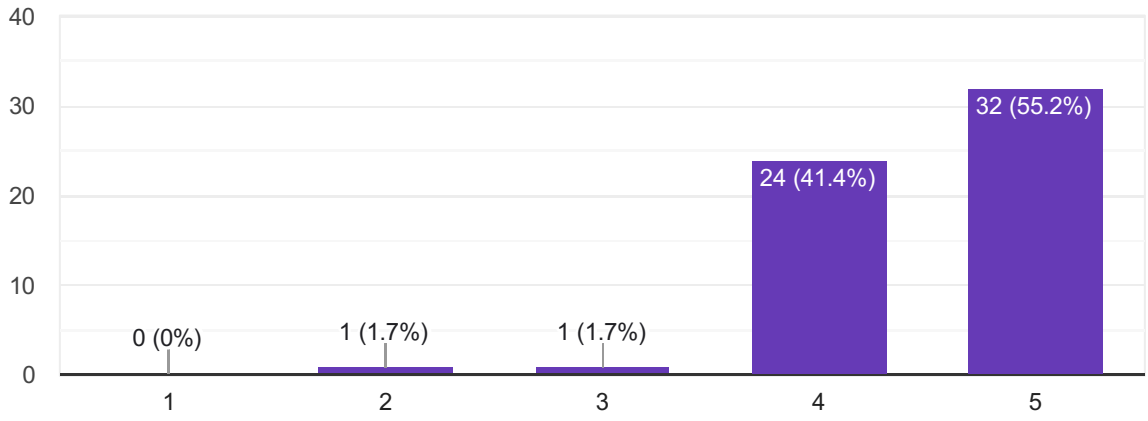
58 responses



Having available funding

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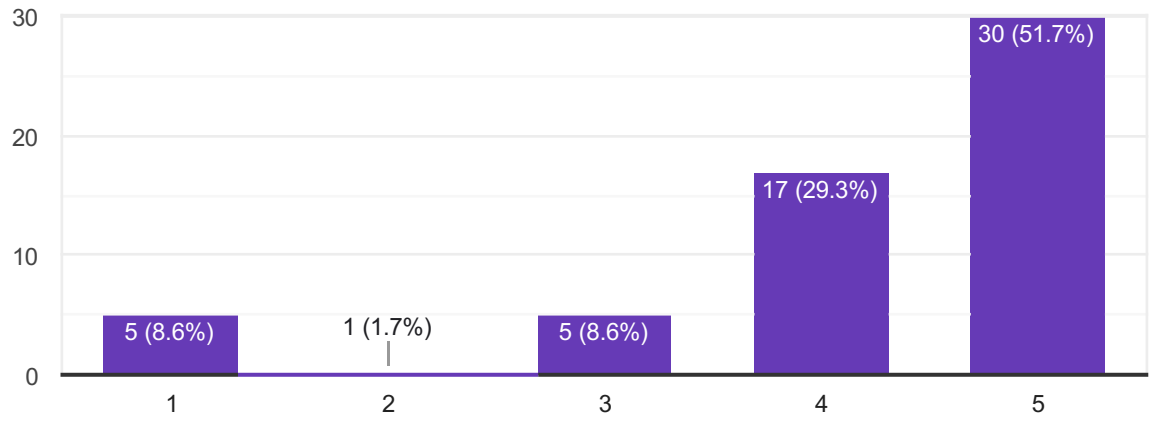
58 responses



Advising style (hands on / hands off, etc.)

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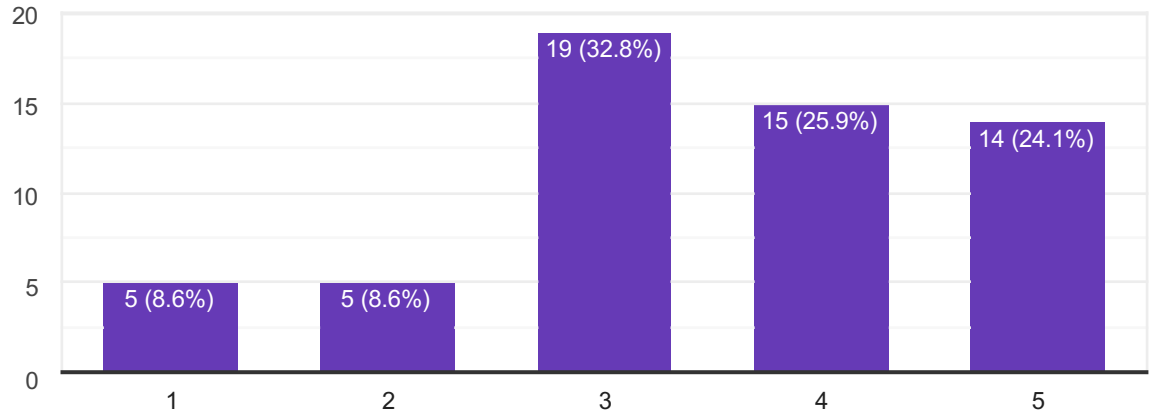
58 responses



Group culture (small vs. big, social activities, etc.)

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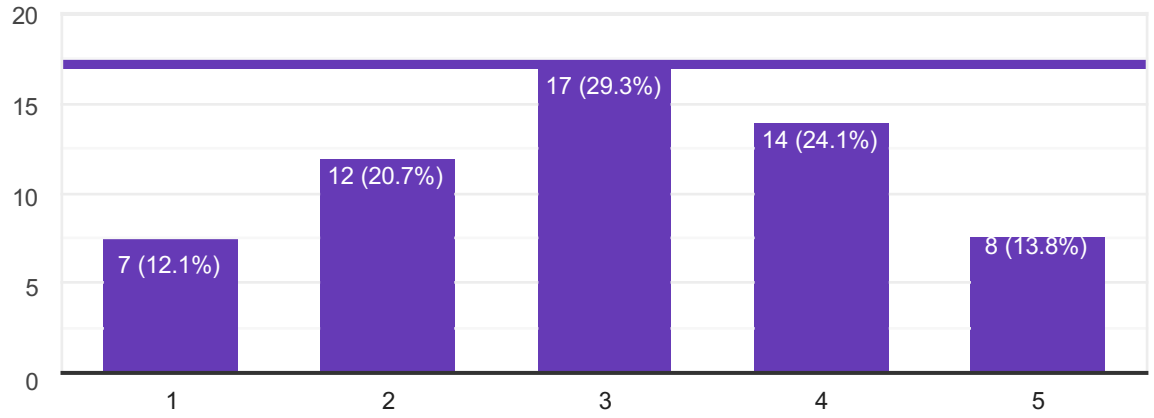
58 responses



Identity (shared gender / personal background)

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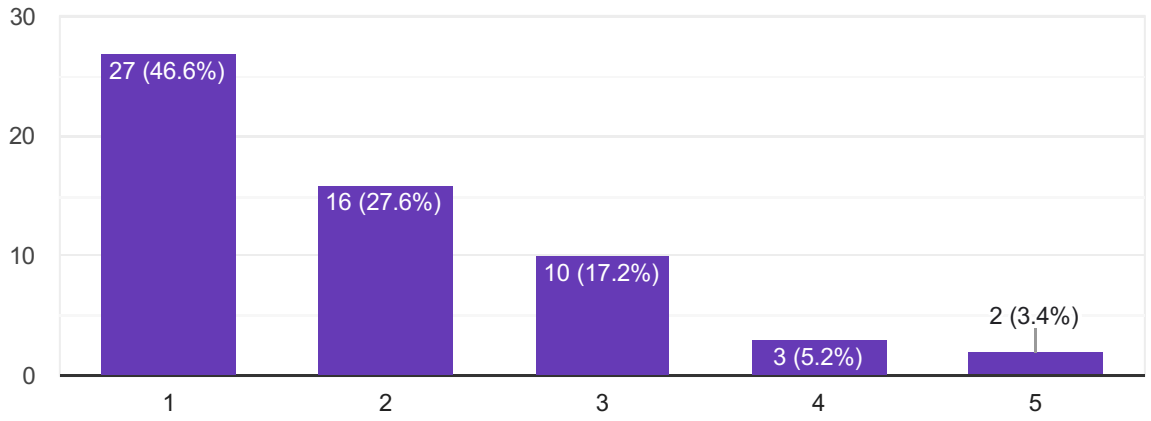

How many potential advisors did you consider and speak with?

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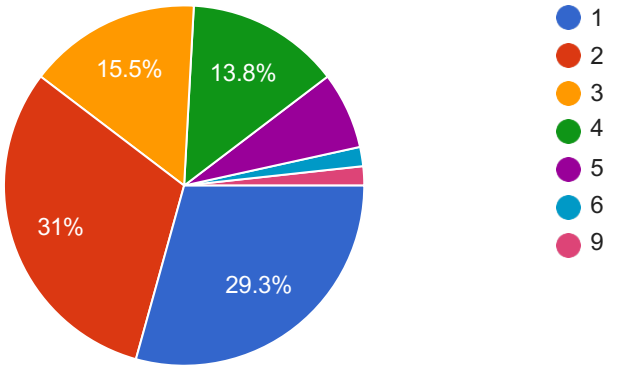

When did you start seriously looking for advisors?

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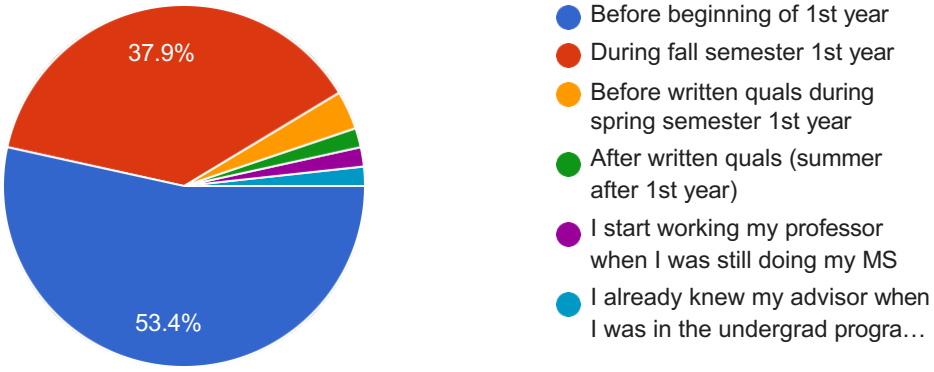

When did you confirm your advisor? (they agreed to fund you/accept you into the group)

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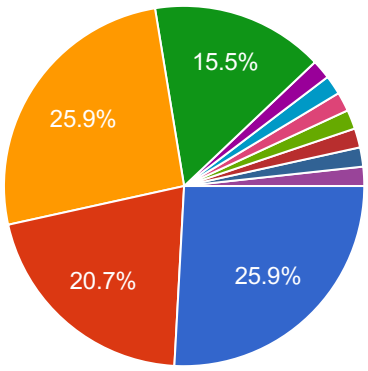
58 responses



- Before beginning 1st year
- During fall semester 1st year
- Before written quals during sp…
- After written quals (summer a…
- My advisor has not confirmed…
- spring 2nd year
- Not confirmed yet
- Have not officially confirmed…

1/2

Did you have time to appropriately evaluate your potential advisors in your first year?

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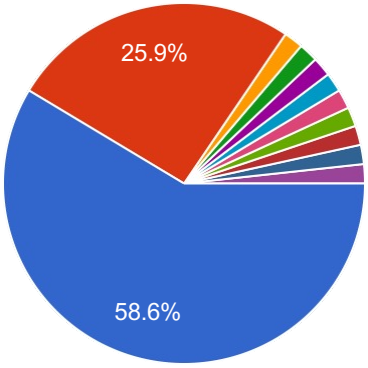
58 responses



- Yes
- No
- N/A
- This question is not relevant,…
- I already had my advisor
- I had time to evaluate the adv…
- I think there could have been…
- i didn't really know how to go…

1/2

When did you start your research?

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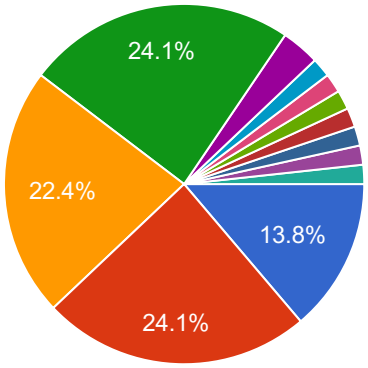
58 responses



- Summer before first year
- First semester first year
- Second semester first year
- Summer after first year
- Fall second year
- During my MS year
- I “started” first semester but h…
- end of fall 2nd year

1/2

Are you satisfied with when you started research?

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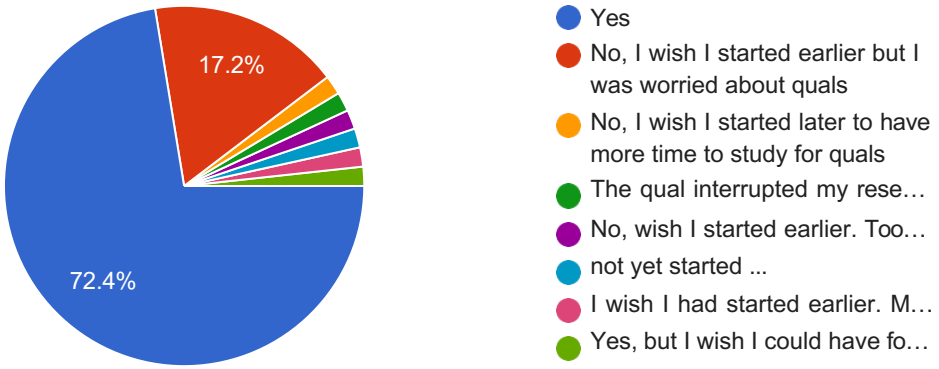
58 responses



Is your advisor in APAM?

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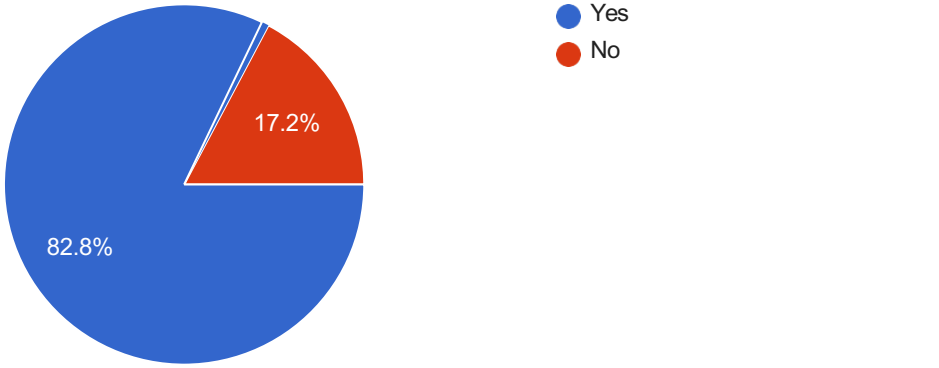

If not, why did you choose an advisor outside of APAM?

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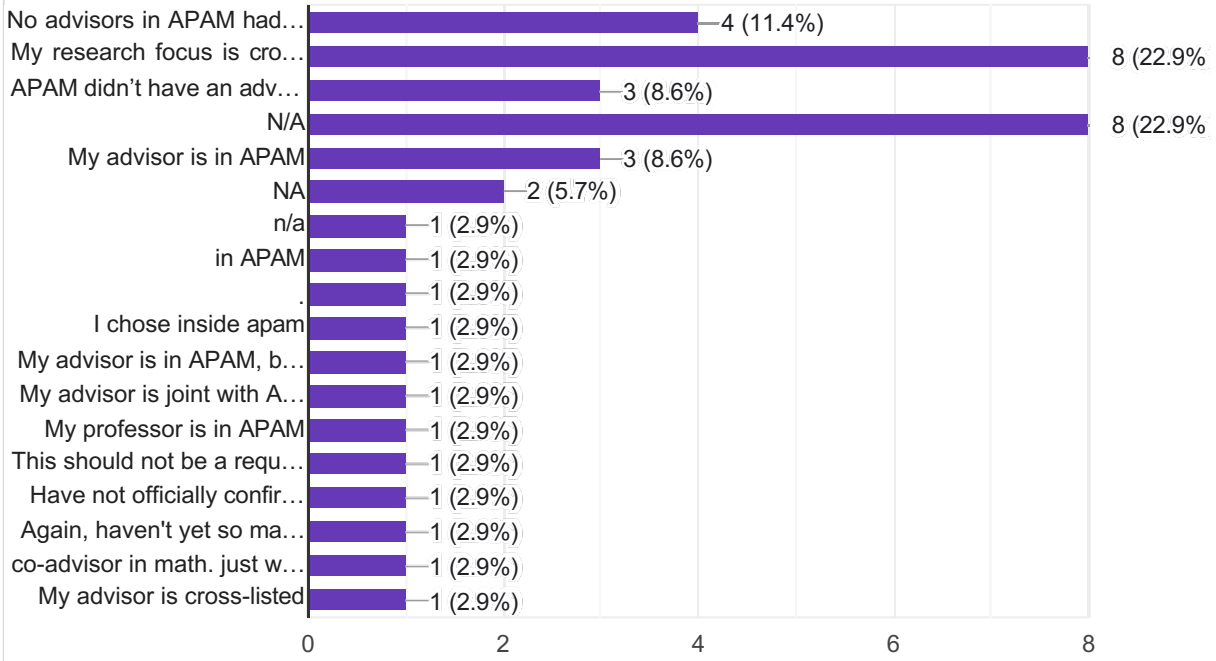
35 responses



(students that have completed 2 years+ only): Are you happy with your choice of advisor?

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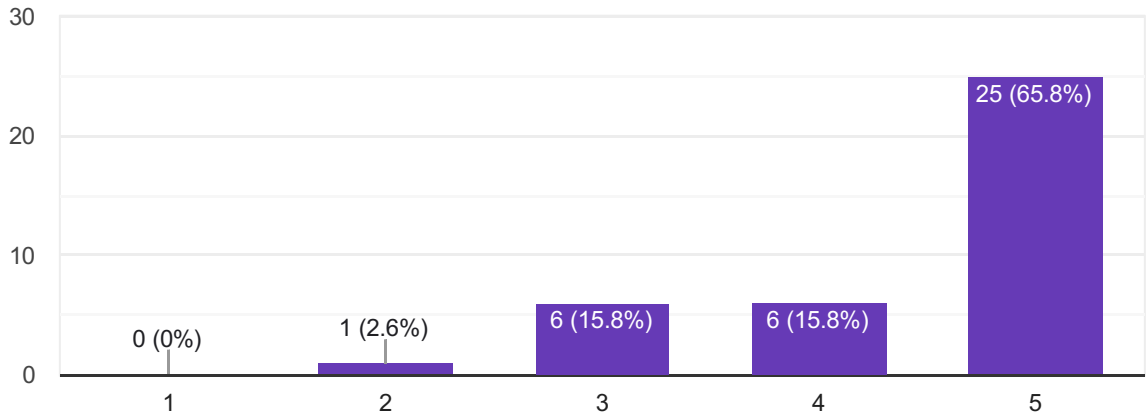
38 responses



Please leave any other comments about the process of choosing an advisor here

19 responses

This was definitely more difficult with Covid, so I just want to note that I think I was fairly lucky with the ease that I had.

Take my feedback with a grain of salt, as I haven't meaningfully interacted with my advisor yet due to how the *[redacted identifying information]* lab operates.

I feel it should be told to incoming students that taking a Research Assistantship in the first year, instead of being a TA, is synonymous with joining the research group of the advisor.

I found the process of transitioning from coursework to research very difficult and I didn't feel well-equipped. I think I acted a bit impulsively re: choosing an advisor without thinking about qualitative aspects like research style, group dynamics, etc and instead based my decision entirely on whether I found the research itself interesting. While this was my own personal fault, I wonder if there is a way to communicate the importance of these aspects to prospective students? Maybe the Friday seminar should be diversified so that instead of only having one-way talks in which a professor or grad students describes their research, there could be interactive sessions about how to succeed in academia, how to propose viable research questions, effective communication, etc. I think this would make the sessions much more compelling for students to attend (at least in my year the attendance dropped dramatically as the year progressed).

Because of the way funding works many people didn't know if they could take a student until the end of the spring semester, so I spent a lot of time talking to people who were interested but later found out they couldn't take me. Everything worked out well for me in the end and I'm not sure what a good solution to this would be but it seems like a common issue.

I appreciate that it's not required to choose an advisor before you come to campus, so that you can experience the group in person before it has to be confirmed

I made sure my advisor had funding for me before I accepted the offer to come to APAM

I think our current system is good regarding this process.

With limited time due to the high course load, it is hard to find an advisor first year, and personally most of my searching happened before arriving at Columbia. However, as someone coming from a different field, the focus on coursework early on helped me build a strong foundational knowledge base, which may have been harder if I spent more time researching with various professors in my first year. All in all, the tradeoff is a difficult one, and I'm not sure how to optimize this for different students.

I enjoyed the process and am very happy with my choice!

There is quite the fiasco with the current batch of Y1 Applied Math PhD students with five of us not having an advisor yet. I will not recount the whole situation here but perhaps it should be looked into

In order to choose an advisor well, it is the best to do research with them. However, the program does not allow for much research during the first year yet makes us decide at the end of the first year.

I think the department should help new students meet with many APAM faculty (1:1), so they can learn more about their research, advising style, etc.

Specifically for the applied math program, there have been difficulties with confirming advisors. I understand that this mostly has to do with the size of the 2021 cohort, but I am confident that the advisor searching process could improve through changing the qualifying process. I often felt that I did not have enough time to seriously evaluate potential advisors during the first year because of the coursework and preparing for the written quals. I think many students would benefit from having more structured guidance on searching for advisors (e.g., required research rotation between professors).

It was difficult process while balancing coursework/ qual studying. Also, potential advisors have suddenly mentioned funding or advisee overload constraints when none were mentioned previously.

above question^: didn't really have many options

I have mixed feelings about the extended evaluation period APAM offers for both advisors and students. On one hand it is good to get to know potential advisors and groups. On the other hand conducting meaningful research work during your first year in APAM is almost impossible and effectively the best you can do is spend a few hours a week in lab familiarizing yourself with potential lab mates and helping assist other more senior doctoral students.

The only way to change this would be to reduce coursework load (and possibly spread it out over ~2 years) and allow students to spend more meaningful time in lab during the first year.

This process is grossly hands-off in APAM. The only check-in from the department we ever had was a survey at the end of our first fall semester if we were thinking about specific advisors and potentially had an idea of who to work with. For those looking outside the department or not sure who to pick/try or received constant rejection letters from advisors outside the department because they had to prioritize students from their home department and/or did not have funding, the support from APAM was abysmal.

One person who left MSE already described a poor experience with the APAM faculty. They expressed interest in some of them as advisors, emailed them to receive prospects that the advisor has space/funding and would like to setup a meeting, just to have the advisor say they don't have funding or weren't looking for students that year at the end of their meeting.

I was only interested in 2 faculty from when I applied to APAM, and I was lucky enough that

both had funding and space for students when I was searching. But it was at times very directionless to hear nothing from the department about potentially what we should be doing or how we were doing in this respect in the first year.

APAM gives faculty too much leeway in how they go about selecting students. This can and has put students in a precarious position where they find out late in the spring that they cannot join a group. Faculty at other universities and departments often seem to manage just fine to hire students from something like an interview, not a year of evaluation.

Section 9 of 11

Quals reform ideas: Case 1: Keeping course-focused quals

In this section of the survey, you can vote on changes to the qualifying exam structure, assuming we keep course-focused written/oral quals as they are now. (except for the last two options in this section, the current quals are eliminated completely)

IMPORTANT:Please pay attention to the meaning of the scale. Consider each choice INDEPENDENTLY.

10: This is an ideal reform to me (Most positive)
5: I agree this is an improvement to the status quo, but it's not ideal to me (Positive)
3: I believe this won't significantly change the quals experience (Neutral)
1: I think this would make it worse (Negative)

If a student fails a written quals question, the student retakes the course instead of having to retake the entire written qualifying exam. There is no threat of being kicked out by the department as long as the student retakes the course and passes.

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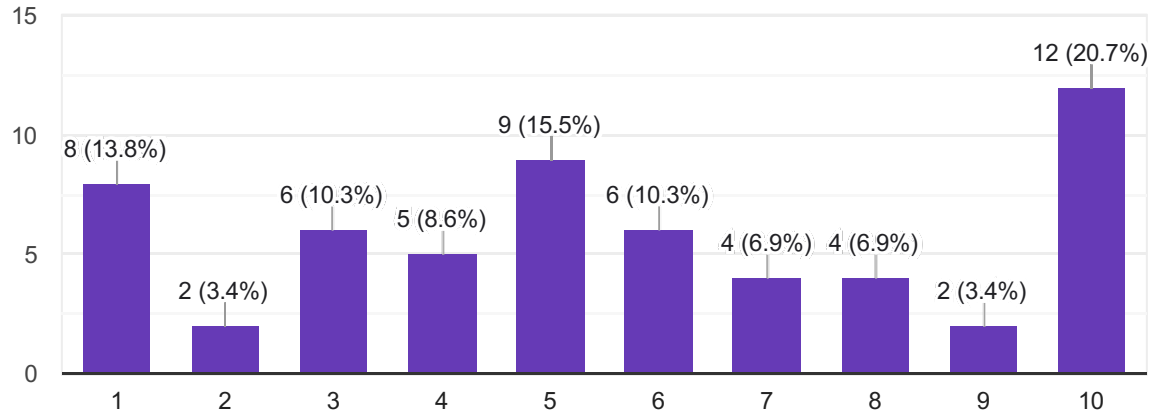
58 responses



For written quals, students are allowed a standardized formula sheet made by the exam writers and the exam taking time is extended by two hours on each day (and the difficulty of questions are to be maintained the same as previous years).

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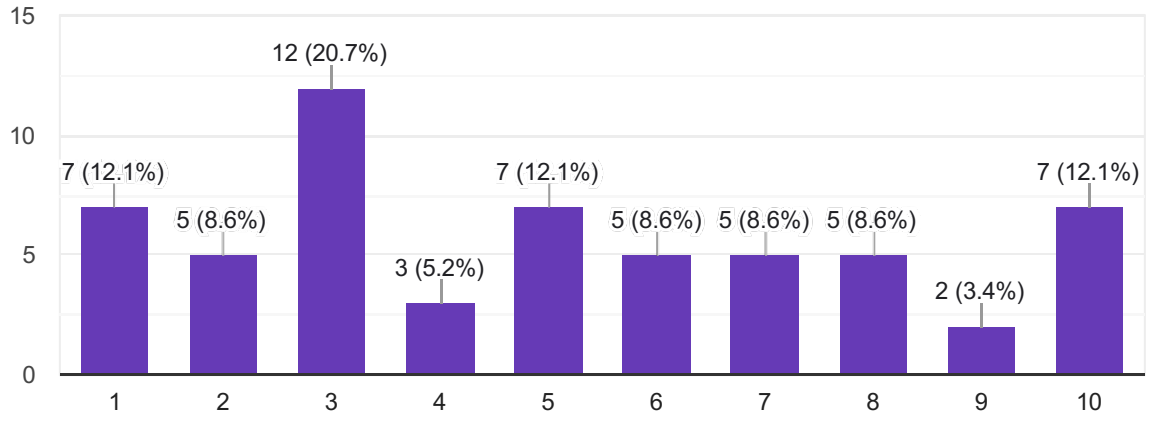

Explicit, clearly communicated list of relevant content for each qual question provided at least a month before the written exam (e.g. a list of textbook chapters relevant to the question)

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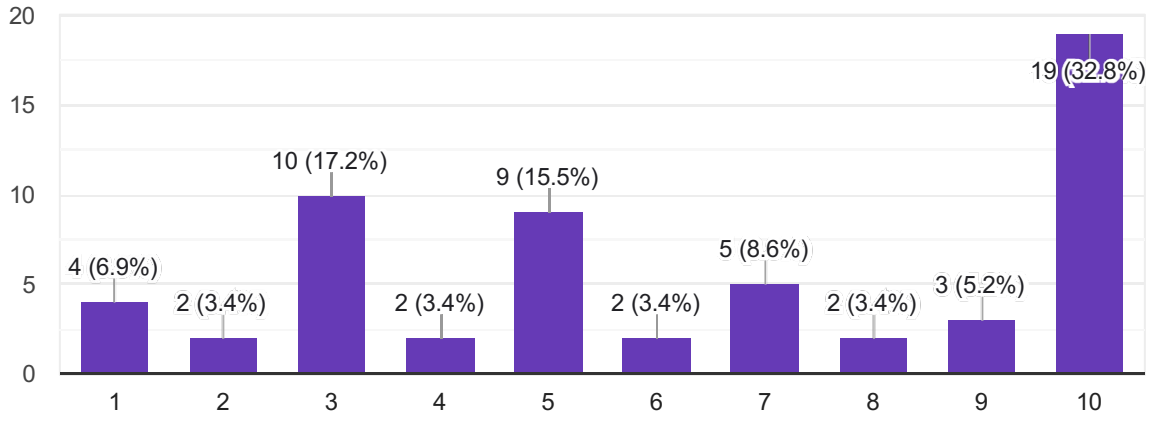

Only a course-based oral exam is administered

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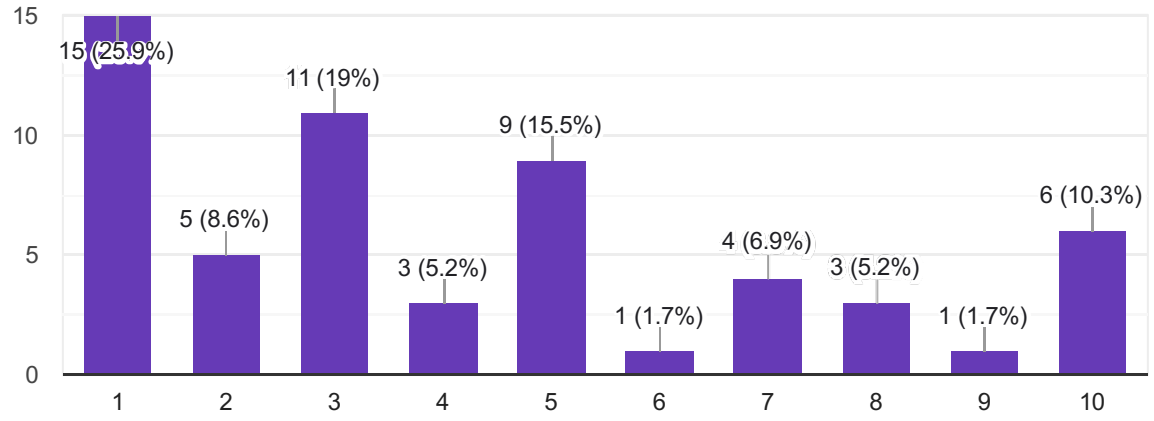
58 responses



Eliminate written/oral quals. Instead administer an optional placement test upon arrival and implement a uniform GPA requirement for PhD students in the core classes that were tested on the former written quals. Students that pass placement test questions can skip that course and take a department approved elective instead. (Optional placement test because some students come in with no background in their program and need to take all classes).

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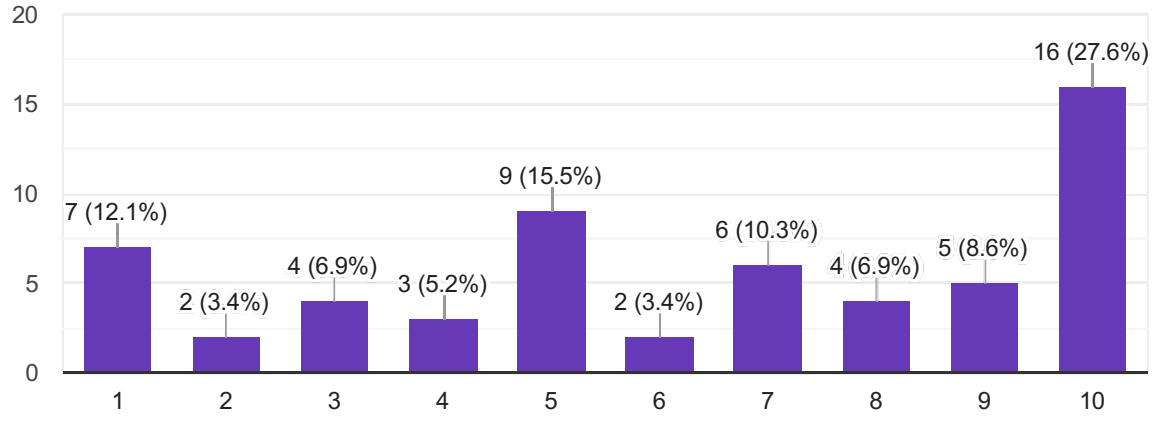
58 responses



Eliminate the current written/oral qualifying examinations completely and replace with research or literature-focused exam. (See possible options in next section)

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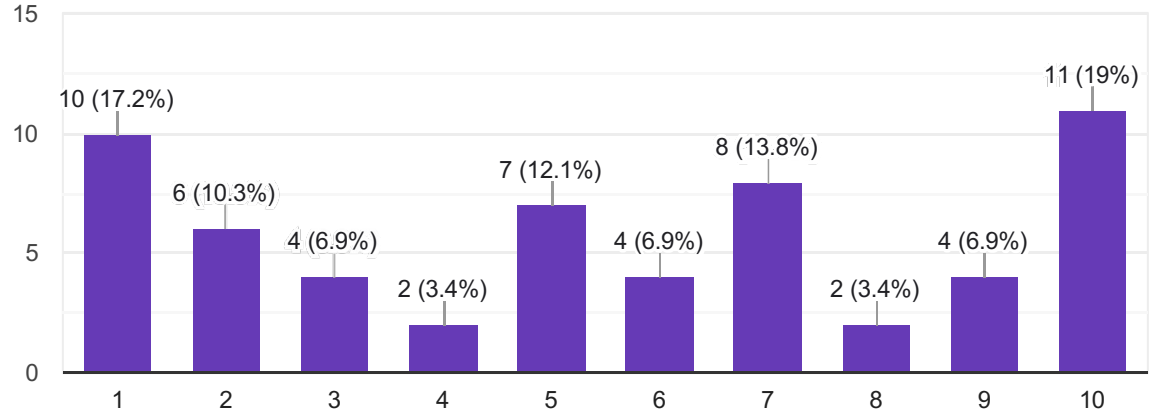
58 responses



Section 10 of 11

Quals reform ideas: Case 2: Replace written + oral quals with research-oriented quals

In this section of the survey, you can vote on changes to the qualifying exam structure, assuming we adopt a research-oriented quals and get rid of the current written+oral quals.

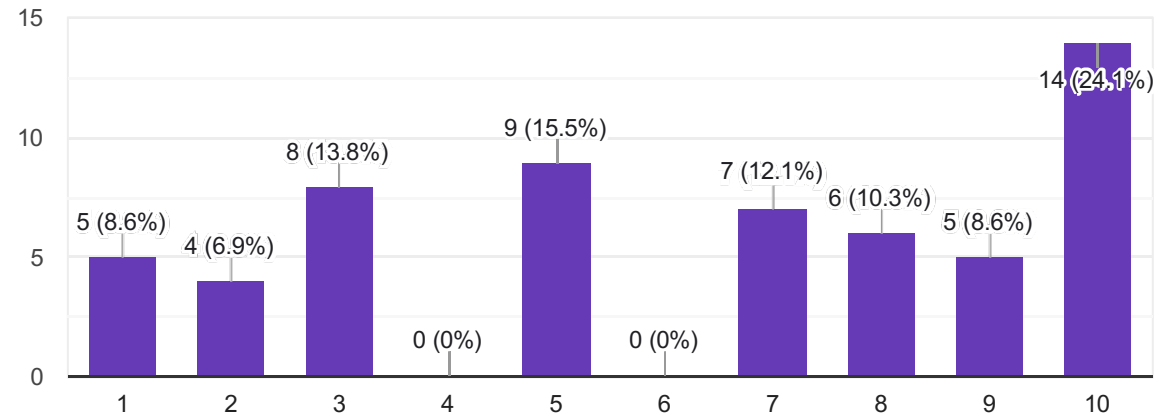
IMPORTANT:Please pay attention to the meaning of the scale. Consider each choice INDEPENDENTLY.

10: This is an ideal reform to me (Most positive)
5: I agree this is an improvement to the status quo, but it's not ideal to me (Positive)
3: I believe won't significantly change the quals experience (Neutral)
1: I think this would make it worse (Negative)

All of these proposed quals structures are taken from other qualifying exams from PhD programs in SEAS

(Research only) At the end of the second semester the 2nd year, the qualifying exam is a 10-15 min presentation of the student's research project and the examiners ask questions about their project as it relates to fundamentals of their program. There is also a written research report.

58 responses



(Research + literature review) At the end of summer after first year, the student will first present their research project idea and progress in 5 minutes. The student will also have to read 3 academic papers related to the student's field of research provided by the faculty committee members at least two weeks in advance (each member will provide one paper). The examiners will ask questions about the papers and how they relate to the proposed research to gauge that the student has fundamental understanding of their field and the challenges in their project.

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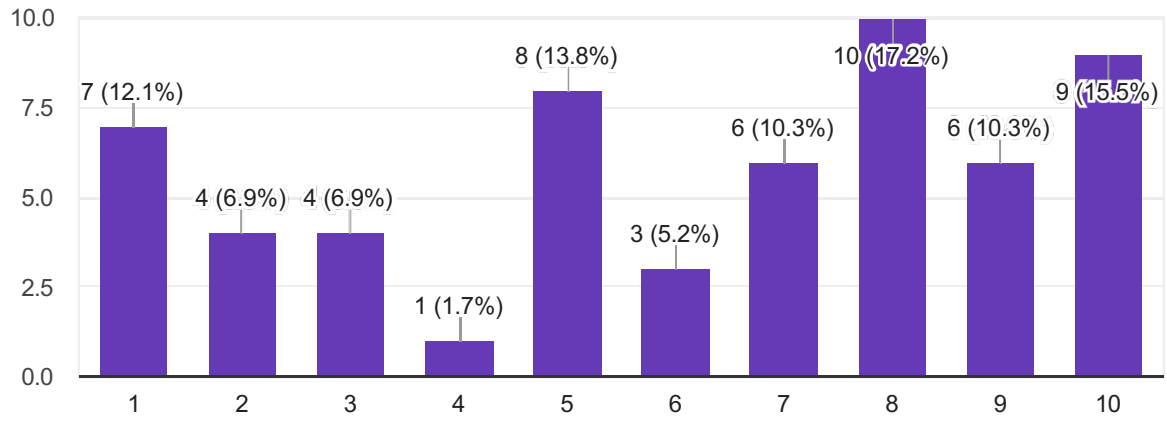
58 responses



(Literature review only) At the end of summer after first year, the student will submit a 6-8 page summary, critical analysis, and literature review of their chosen research problem/topic of interest. There will then be a presentation and oral exam of the content of this report to gauge the student's understanding of the fundamentals of their field and the challenges specific to their chosen topic.

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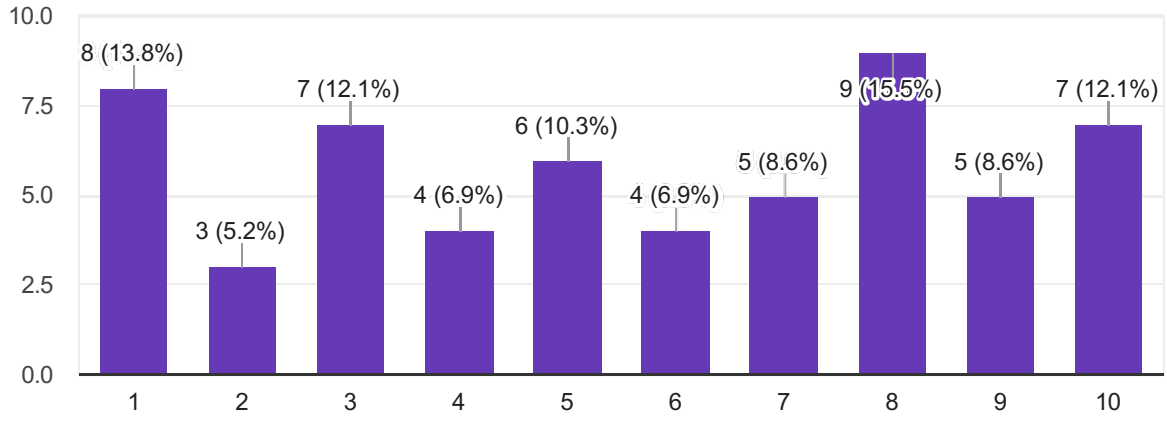
58 responses



Demographics

Do you identify with any of the groups below? Please select as many as you identify with.

Copy

58 responses