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Article

Effectiveness of Doctoral Defense Preparation Methods

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Abstract: The doctoral defense is an important step towards obtaining the doctoral degree, and preparation is necessary. In this work, I explore the relation between the way in which a doctoral candidate prepares for the defense and two important aspects of the defense: the outcome of the defense, and the student perception during and after the defense. I carried out an international survey with an 11-point Likert scale, multiple choice, and open-ended questions on the doctoral defense and analyzed the data of the 204 completed surveys using quantitative and qualitative methods. The methods I used included the statistical tests of the correlation between, on the one hand, the preparation and, on the other hand, the defense outcome and student perception. I used an inductive thematic analysis of the open-ended survey questions to gain a deeper insight into the way candidates prepared for their defense. I found that candidates most often prepare by making their presentation, reading their thesis, and practicing for the defense. The most effective measure is the mock defense, followed by a preparatory course. The conclusion of this work is that doctoral candidates need to understand the format of their defense in order to be able to prepare properly, and that universities should explore either individual pathways to the defense or pilots using a mock defense and/or preparatory course to prepare their doctoral candidates for the defense.



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1. Introduction

At universities where the doctoral thesis is defended orally, the doctoral defense is an important step towards obtaining the doctoral degree [1–7]. Because the doctoral defense is often considered the culmination of years of work, but at the same time shrouded in mystery, studies of the defense itself, as well as how doctoral candidates prepare for it, are necessary.

The doctoral defense is different from a regular oral exam [8–12], as it fulfils a number of functions: examination, rite of passage, confirmation, celebration, and more. There may be some overlap in the way doctoral candidates prepare for their defense and the way in which they prepare to give a conference presentation: for both occasions, the candidate may read through the thesis or paper in preparation, as well as make and prepare a presentation. However, since in most defense formats the time spent presenting the research is smaller than the time spent answering committee questions, the importance of questions at a conference presentation is smaller than at the doctoral defense. In addition, the stakes are much higher at the doctoral defense than at a conference presentation.

Depending on the country and defense format, the doctoral defense may influence the assessment of the thesis and the required amount of revisions [13], and failing the doctorate after an unsuccessful defense is possible in some universities (60% of 20 British universities analyzed give examiners the option to fail a candidate based on their *viva* performance) [14]. Therefore, doctoral candidates should prepare properly for the event.

There are also differences as a function of the type of doctorate. Most doctorates are research-focused PhD degrees, but other types of doctorates (such as the Ed.D, PDEng,

Ed.Psych, etc.) can have a more practice-oriented focus and this focus will influence the defense proceedings as well.

A first step in the preparation lies in understanding the defense format, as different expectations are associated with different defense formats [15]. A second step in the preparation consists of understanding the breadth and depth of preparation necessary. Here, anecdotal evidence is contradictory. In the testimonies about the doctoral defense that I have gathered over the past decade, the advice from former doctoral candidates (both Ph.D. and Ed.D. candidates) varies widely. Some former candidates recommend an extensive preparation that involves preparing the presentation, having a mock defense, practicing with typical defense questions and preparing answers, rereading emails from committee members and notes from meetings with them, and marking up the thesis [16], whereas others recommend being confident and not practicing the presentation too much [17].

In this research, I want to answer the following research questions: How does the preparation for the doctoral defense influence the outcome of the defense? How does the preparation for the defense influence the student perception? Studying these research questions allows us to evaluate the effectiveness of potential university-wide courses prior to the defense, or requiring a mock defense, as well as to evaluate the effectiveness of additional reading about the defense in anticipation. This work can be considered a first step towards better preparation policies in doctoral schools internationally.

2. Literature Review

2.1. Preparation for the Doctoral Defense

Only a handful of studies in the literature deal with the preparation of the doctoral defense. The author of [18] remarked that, because of the unpredictability and mystery around the doctoral defense (here, the *viva voce* from the United Kingdom), “*development of effective strategies aimed at a positive outcome requires judicious attention*”. This advice aligns with the cautionary account of [5] who detailed a viva that followed the rulebook but where the candidate almost failed as a result of letting down his intellectual guard. It could be argued here that the candidate did not understand the purpose and the expected behavior correctly, and that better preparation could have avoided such a situation.

Indeed, a misunderstanding of the defense is common. Research involving 16 focus groups, each consisting of between 10 and 16 students, looked at the anticipation and knowledge of doctoral candidates about the defense [19]. One of the findings was that some students do not properly understand the requirements or format of the defense. In particular, some students wrongly identified the nature of the defense as a quiz or a friendly chat. In addition, some students were confused about the possible outcome of the defense, the length of time of the defense, the regulations and rules of conduct during the defense, and the role and procedures for the appointment of the examiners. Another surprising outcome is that the main source of information for those about to take the doctoral defense is friends who already passed their defense.

Charting the ways in which doctoral candidates prepare for the defense, [20] found the following in the context of the UK *viva*: 73% relied on supervisor advice, 71% considered presentations at conferences as preparation, 53% presented at internal seminars, 47% read PhD advice books, 25% had a mock *viva*, 10% relied on family advice, and 7% attended *viva* preparation workshops.

The first way to prepare for the defense, as illustrated in the literature, is to reread the thesis [18]. Being fully familiar with the contents of the thesis is the first step in being able to defend the research. Moreover, it serves the purpose of preparing to demonstrate authorship, which was found as one of the stated purposes in reviewing the published guidelines for the *viva* from 20 universities in the UK [14]. During the reread of the thesis, the candidate is also recommended by the literature to find potential topics for debate during the defense, and critically analyze the strengths and weaknesses of the work [18].

A second way of preparing for the defense happens during the doctoral trajectory. The author of [19] recommends that doctoral candidates attend the defenses of their peers,

where the defense format allows this. Having seen peers defend and having observed the interaction between the committee and candidate is an extremely valuable step in the preparation.

A third element of preparation that is recommended in the literature is the use of a mock defense. A variety of possible arrangements for a mock defense are possible [18]: from a practice run of the defense presentation to the research group and answering questions from colleagues [21], over a format in which the supervisor (and potentially other colleagues) ask the candidate critical questions to practice answering committee questions, to a format where the candidate is examined on a small section of the dissertation. The use of a trial run of the defense presentation is described in an autoethnography in [21], where the author describes her experience with the practice run, the feedback received, and final defense presentation. She considered the interaction with colleagues and peers an essential formative experience, summarized as: *“Amidst the pressure of today’s increasingly public research context, participating, in practice, as practice, through practice, has become a pedagogical imperative”*.

Research found that the most effective mock defense is one that is as similar to the real defense as possible [18], in terms of type, content, and setting. Making sure that the mock defense resembles the actual defense as closely as possible requires time and effort, and it also requires that all those who participate in the mock defense take their role seriously and enact the mock defense with the same rigor as a real defense. The author of [18] pointed out that while the questions during the mock and real defense will be different, it helps students understand the dynamics and challenges at play during the defense, and it may be particularly beneficial for students who are not native speakers.

A final way to prepare for the defense mentioned in the literature is a preparation course. One structure, as explained by [19], is to explore with the doctoral candidates their feelings (positive and negative) in anticipation towards the defense, as well as what they know and do not know about the defense. In particular, it is important that universities clear up the confusions their doctoral candidates have about the purpose and proceedings of the defense. A particular topic that a course should address relates to the expected conduct during the defense. Of course, this conduct is a difficult topic, as it deals with the interaction between the candidate and committee members, and below the surface, various factors (sociodemographic, cultural, and more [22]) play an important role.

2.2. Research Gap

From the literature, I identified two gaps to be addressed with research. The first gap is that the defense has mostly been studied in a national context. It is important to broaden the discussion about the doctoral defense by looking at insights from an international pool of doctoral candidates. The vast majority of work on the doctoral defense has been carried out in the Anglophone sphere: United Kingdom [4–6,12,13,19,21,23–25], Australia (where the thesis is assessed in a written form) [26], New Zealand [27], and the United States [28,29]. At the same time, there is an interest in the European Union to work towards a standardized format of the defense [28–34].

The second gap in the literature is with regard to the relation between the preparation for the defense and the outcome of the defense in terms of result and in terms of how students experience their defense. Existing research looks at potential forms of preparation (and in particular a preparatory course and the mock defense), but they do not link these suggestions to how students perceive the defense or to the outcome of the defense. This research addresses these gaps in the literature and addresses as well preparatory reading on blogs and in books, as Share [19] highlighted that almost half of all doctoral candidates read PhD advice books in preparation for their defense.

3. Materials and Methods

3.1. Survey Design

The data I used to study the impact of preparation on the outcome of the defense and the perception of students comes from a larger survey on the topic of the doctoral defense. The instrument and study received IRB exemption 2019-139IN through Universidad San Francisco de Quito. The survey consisted of 54 questions around three topics: sociodemographic aspects, elements of the defense format and defense preparation, and perception of the defense and its long-term impact. A variety of types of questions were used: multiple choice questions that either allowed one selection or all that apply (40 questions), sliding-scale ratings using an 11-point Likert scale [35] (7 questions on sentiments and 1 about defense format), short form open-ended questions (3 questions, on year of birth, year of defense, and email address), and long form open-ended questions (3 questions in total). The survey in full can be found with the supplementary material of a previously published article [15].

Of particular interest to this research, are the open-ended questions Q46 “How did you prepare for your defense? Please summarize the actions you undertook to prepare for your defense” and Q64 “In hindsight, would you have prepared differently for the defense? Describe what you would have done differently”. An example of the multiple-choice questions is Q44 “Did you attend a course to prepare for your defense? (answer choices: Yes, course about the defense itself. Yes, as part of another PhD course. No). There are also multiple-choice questions about the defense that allowed participants to select multiple answers: Q57 “How would you describe the purpose of your defense? Select all that apply” (answer choices: examination, ceremony, celebration, confirmation, rite of passage, other (providing space to give a suggestion)). The analysis in this paper also uses Likert-scale questions about the experience during the doctoral defense, such as Q48 “On a scale from 0–10 how nervous were you before the defense, during the defense, and after the defense (but before receiving the outcome)?” (sliding scale for the three points in time go from 0 “not nervous at all” to 10 “extremely nervous”). The full set of questions and answer options are given in [15].

3.2. Analysis Methods

This study used a combination of qualitative and quantitative methods. To prepare the data for analysis, and after closing the survey, I first read all answers horizontally (all answers to one question) and vertically (full survey answers per respondent) to get a first insight into the responses. Then, after filtering out surveys that were empty or did not reach the final question, I developed the first report of the results and downloaded the data as an MS Excel sheet.

For the quantitative analysis, I used Matlab R2019a [36]. Using a coded .m-file, I read in the various columns from the Excel sheet. Where necessary, I created additional columns in Excel to recode the input columns from text into numerical values. Then, my programmed routine sorted out the empty cells from the created vectors, carried out the statistical tests, and grouped data into breakdown tables. I also cross-checked these results with the breakdown option on the survey platform. The statistical tests that I used are the Wilcoxon rank sum test for cases where there are only two categories of a type of defense preparation, and the Kruskal–Wallis test when the analysis involved more than two categories of a type of defense preparation [37]. I considered a p -value of <0.05 as an indicator of correlation and $0.05 \leq p < 0.1$ as a weak indicator of correlation.

For the part of the statistical tests in the data analysis, I developed the analysis matrix shown in Table 1. This table shows in one column the aspects of defense preparation (3 in total) and in the other column the aspects of defense outcome (2 in total) and student perception (14 in total). Between brackets I included the question number from the survey for reference. The total number of analyses of statistical tests is thus $3 \times 16 = 48$.

Table 1. Matrix of analysis between categories of defense preparation and categories of defense outcome and student perception [15].

Preparation of Defense		Defense Outcome
1	Mock defense (Q43)	Defense outcome (Q19)
2	Preparation course (Q44)	Length of defense (Q26)
3	Preparatory reading (Q45)	

Preparation of Defense		Defense Perception
1	Mock defense (Q43)	Nervousness (Q48)
2	Preparation course (Q44)	Enjoyment (Q49)
3	Preparatory reading (Q45)	Perceived fairness of committee (Q50)
4		Perceived committee suitability (Q51)
5		Perceived importance (Q52)
6		Difficulty of defense (Q53)
7		Formality of defense (Q54)
8		Seriousness of defense proceedings (Q55)
9		Purpose of defense (Q57)
10		Perceived academic competence after defense (Q59)
11		Desire to continue in field after defense (Q60)
12		Desire to remain in academia after defense (Q61)
13		Perceived publishability of research after defense (Q62)
14		Overall perception of defense as valuable experience (Q63)

For the qualitative analysis, I used inductive thematic analysis [38–40]. For this purpose, I used the text analysis feature on the survey platform. The first step in this analysis was to read again all the answers to the open-ended question. Then, I tagged topics to each of the responses individually. At the same time, I took notes about these topics, to develop the associated memo. In a next step, I looked at all the topics to check for potential overlap, duplication, or typing errors. Then, I started to sort these topics into parent categories of overarching themes. A few weeks later, I read through the parent categories and subthemes again, and adjusted themes and topics where necessary. Finally, I exported the text analysis results as .csv files to open in MS Excel to develop summary tables. The exported results from the text analysis also included the information of the counts, so I rearranged the results from themes that were most often mentioned to those least often mentioned. Using this approach, the themes surfaced from the data of the survey and analysis procedure and were not influenced by any idea I may have had a priori.

3.3. Participants

Participants filled out the survey on the online Qualtrics platform between 13 July 2020 and 3 October 2020. They were recruited through social media and by email from my personal network, and thus represent a self-selecting convenience sample [41]. As social media was used, with hashtags and tagging other users with a large academic reach, not all participants are directly from my personal network.

It took the respondents between 2.5 min and 81 h to submit the survey (average = 39 min and median = 10.6 min). Since the respondents could return to the survey at any time, provided that they used the same IP address, those responses with longer times before completion most likely came from those who returned to the survey after a pause.

The total number of respondents of the survey was 296. The anonymized dataset from the survey is provided in the public domain [42]. Of these responses, I filtered out 204 responses that were complete up to the last question, and I used only this filtered dataset for the analysis. The respondents were not required to answer each question, and for this reason I have included the *n* of responses throughout this paper.

An overview of the sociodemographic characteristics of the respondents, broken down by outcome of the defense, is shown in Table 2. The characteristics that are included are: gender, ethnicity, current employment, age at defense, and field of study. The results

are also broken down by outcome of the defense, into the categories “Passed”, “Minor corrections”, and “Major corrections”. We can see from Table 2 that the majority of the respondents self-identified as female (64.4%), white (72.4%), and employed in academia (76.2%). Most of the respondents (70.8%) were between 26 and 35 years of age at the time of their defense. The respondents are distributed among different fields of study, with the largest representation in the Social Sciences (29.9%) and STEM (28.4%) and the lowest representation in the Multidisciplinary field (4.5%).

Table 2. Characteristics of respondents in terms of sociodemographic aspects, broken down by outcome of the defense.

	Total	Passed ²	Minor Corrections	Major Corrections
	<i>n</i> = 204	<i>n</i> = 139	<i>n</i> = 57	<i>n</i> = 7
Gender ¹	<i>n</i> = 202	<i>n</i> = 138	<i>n</i> = 57	<i>n</i> = 7
Male	35.6%	68.1%	29.2%	2.8%
Female	64.4%	68.5%	27.7%	3.9%
Ethnicity	<i>n</i> = 199	<i>n</i> = 135	<i>n</i> = 57	<i>n</i> = 7
White	72.4%	66.7%	28.5%	4.9%
Black or African American	3.5%	57.1%	42.9%	0.0%
Asian	8.0%	68.8%	31.3%	0.0%
Latinx/Hispanic	6.5%	69.2%	30.8%	0.0%
First Nations	0.5%	100%	0.0%	0.0%
Mixed	2.0%	50.0%	50.0%	0.0%
Other	7.0%	85.7%	14.3%	0.0%
Current employment	<i>n</i> = 202	<i>n</i> = 138	<i>n</i> = 57	<i>n</i> = 7
Academia	76.2%	70.1%	27.9%	2.0%
Industry and business	13.9%	60.7%	32.1%	7.1%
Government	4.0%	62.5%	25.0%	12.5%
Unemployed	3.5%	85.7%	14.3%	0.0%
Other	2.5%	40.0%	40.0%	20.0%
Age at the defense	<i>n</i> = 195	<i>n</i> = 134	<i>n</i> = 54	<i>n</i> = 7
<26	2.6%	80.0%	20.0%	0.0%
26–30	39.5%	67.5%	27.3%	5.2%
31–35	31.3%	70.5%	27.9%	1.6%
36–40	13.3%	69.2%	26.9%	3.8%
41–45	5.6%	54.5%	36.4%	9.1%
46–50	4.1%	87.5%	12.5%	0.0%
>50	3.6%	57.1%	42.9%	0.0%
Field of study	<i>n</i> = 201	<i>n</i> = 137	<i>n</i> = 57	<i>n</i> = 7
Life sciences	22.9%	76.1%	21.7%	2.2%
Humanities and arts	14.4%	58.6%	24.1%	17.2%
Social sciences	29.9%	70.0%	30.0%	0.0%
STEM	28.4%	68.4%	29.8%	1.8%
Multidisciplinary	4.5%	44.4%	55.6%	0.0%

¹ Note that no respondents self-identified as “other/prefer not to say” gender. ² The results of the outcome of the defense are presented by breaking down the categories into the percentages that passed, had minor corrections, or major corrections, i.e., by row, whereas the “total” results show percentages by column.

Participants had defended their thesis between 0 and 49 years from the date of filling out the survey, with a median time of 3 years and average of 6.2 years. A relatively small group (14%) answered the survey during the same calendar year they defended their thesis, another small group (17%) had defended more than a decade before filling out the survey, and the majority (52%) of respondents filled out the survey between 1 and 5 years after their defense.

The survey respondents represent an international sample with doctorates obtained in 31 different countries and residing in 34 different countries at the time of filling out the survey. The respondents represent all six inhabited continents. The most represented

countries where the respondents obtained their doctorate are: the United States (33%), the Netherlands (16%), the United Kingdom (12%), Canada (9%), France (3%), and Spain (3%). The most represented countries where the respondents currently reside are: the United States (30%), Ecuador (13%), the Netherlands (13%), the United Kingdom (9%), and Canada (8%).

The questionnaire did not inquire about potential employment during the doctorate, and thus does not distinguish between the experiences of those who are full-time doctoral candidates and those who are part-time.

4. Results and Analysis

4.1. Defense Outcomes

In this article, I present the outcomes of the survey questions with regard to the preparation for the defense. The preprint of this article [43] contains more details of the results and analysis, which are not included in this article to preserve the narrative.

With regard to the defense outcome, the overall results are as follows: 68.5% of participants passed, 28.0% had minor corrections, and 3.5% had major corrections. The length of the defense was less than 1 h for 11.9% of the respondents, between 1 h and 1.5 h for 27.4%, between 1.5 and 2 h for 34.3%, between 2 and 3 h for 21.4%, and longer than 3 h for 5.0% of the respondents.

4.2. How Do Doctoral Candidates Prepare for Their Defense?

In terms of preparation for the defense, the largest group (42.6% of participants) did not have any form of practice. About a third (33.7%) had a mock defense, and the remaining part (23.8%) had another type of practice for their defense. The vast majority (91.6%) of respondents did not attend a course to prepare for the defense. A small group (5.5%) of respondents attended a course about the defense itself and the remaining group of respondents (3.0%) received instruction as part of another PhD course.

The majority of respondents (77.2%) also did not read a book, chapter, blog post, or website in preparation for the defense. Of those (22.8%) who consulted written resources, 39 respondents specified the source they consulted. In order of frequency, these resources were websites, blogs, books, general resources, resources provided by the university, papers about the doctoral defense, and YouTube video content (recording of the defense and tips for the defense). Of those who consulted websites, most respondents mentioned that they used search terms in a search engine to find relevant websites and articles. Two resources that are mentioned in particular are the PhD *viva* guide from NUI Galway [44] as well as online discussions. For those who mentioned that they consulted blogs, the resources mentioned by the participants were: PhD Talk [45], Patter [46], Thesis Whisperer [47], GradHacker [48], The Professors is In [49], and *Viva Survivors* [50]. The book references listed were: *How to get a PhD* [3], *The A-Z of the PhD Trajectory* [51], *How to Survive your PhD* [52], and *How to survive your viva* [53].

An open-ended question (Q46) addressed the preparation for the defense, asking respondents to describe the actions they undertook to prepare for their defense. The most frequently mentioned category from the inductive thematic analysis of these answers is preparing the presentation for the defense, followed by reading the thesis. Respondents also mentioned practicing (through a mock defense, presentations for an audience, or other forms of practice) and preparing to answer questions that may come up. Respondents who practiced for the defense mentioned the mock defense, practicing in front of colleagues, peers, or the supervisor, as well as practicing for the defense. These actions are reflected by “Gave practice presentations to friends and colleagues who had already passed their defenses successfully” and “Mock defense with my lab and with friends who had already defended”. Others revisited the research, by addressing issues in the data analysis, analyzing the strengths and weaknesses of the thesis, developing a tree of theoretical concepts, reading literature, and reviewing the methodology and framework. A lower number of respondents mentioned the committee as part of the preparation, through meetings with committee members or

by reading work by the committee members. The role of colleagues, professors, and the supervisor is reflected by mentions of getting advice and feedback from them, as well as having discussions with them in preparation of the defense. Respondents also mention practical issues in preparation, such as arranging the technology necessary for the defense, food and snacks, preparing clothes for the defense, and focusing on well-being through rest, relaxation, sports, and spiritual practices. Some respondents consider writing the thesis and the years of doing the research crucial to preparing for the defense, and others consider their previous publications (journal papers or conference papers that were presented orally) crucial for the preparation. Highlighting the main contribution of the thesis by emphasizing the novel findings of the work was also mentioned as a preparation step. Finally, a few respondents also attended defenses, did nothing to prepare for the defense, worked on their propositions, read blogs about the defense, or worked on improving their public speaking skills. With 385 tagged mentions for 171 responses, most respondents used strategies from various parent categories, as reflected by:

I went over all the main points in the dissertation and prepared an outline that also included charts, for example, detailing my innovations and contributions to the field chapter by chapter and then also for the theoretical mainframe I built a tree of concepts with my main theoretical contributions at the core, even if they were just disputing accepted views in the field, so giving it more of a critical weighting or expanding it into new scenarios and considerations. I also tried to incorporate all of the feedback that I had received from committee members at that time, even though I only had this feedback from 3 out of the 5 committee members.

and

Made presentation, showed supervisor who gave feedback, meeting with supervisor who told me what to expect, and how to deal with different types of typical questions, practiced presentation in front of some friends, looked through defense clothes with a friend.

Another open-ended question (Q64) addressed if respondents in hindsight would have prepared differently for the defense. Almost half of the respondents indicated they would have done nothing different, either because they felt well-prepared, or because of the unpredictability of the defense, as reflected by:

No, in the UK [the defense] is very much driven by the examiners so the experience can vary quite a lot depending on whom you get as examiner, whether is from the supervisor's academic circle, etc., so it is difficult to anticipate.

The second most mentioned category includes the respondents who would have benefited from more preparation, by attending defenses, having more time to prepare, practice more or practice answering more questions, read more, or reflect more on the connection to other research. Some respondents indicated they would have gone into the defense with a different mindset, by being more confident, more relaxed, or treat the defense more like a job interview. Others indicate they would have presented their thesis differently: either by tailoring it more to the committee, or by focusing more on the broader picture. Some respondents would have wanted a different interaction with their committee by having a more (gender-)balanced committee or by consulting more with them, as reflected by:

I would have insisted on having feedback from all of the committee members before the defense so there wouldn't be any surprises. I could have prepared better in advance if I had known all the criticism before, particularly the negative comments.

Some respondents would have wanted more support from their supervisor and university. Practical issues such as the technology, defense clothes, university bureaucracy, and time to schedule the defense were also mentioned as elements the respondents would like to see different. Those who mention the mock defense as something to change either would have benefited from a mock defense or having a mock defense that is more in line with the actual defense. Research and writing issues that ultimately influenced the

defense, such as data analysis flows, approaching the entire doctorate differently, or having publications were also mentioned. Finally, a few respondents would have prepared less for the defense, would have asked for more feedback from peers or their supervisor, or mentioned that nowadays the defense would be different. In addition, some respondents mentioned the positive experience they had during their defense, whereas others flagged committee misconduct or lamented the negative experience they had. An example of a positive experience is:

Honestly, I would not. I surprised myself by how much in control I was and received a lot of praise for the elegance, clarity and accessibility of my talk. Overall, I felt that I was ready and despite the stress I truly enjoyed the chance to discuss my work with the public and the members of my committee.

An example of an unexpected negative experience is:

... / ... I had had no reason to believe I would be asked to revise and resubmit until I was actually there.

4.3. Effectiveness of the Mock Defense

The mock defense has a positive impact on some elements of perception of the defense. The first aspect where having a mock defense has a statistically relevant influence ($p = 0.041$) is the nervousness after the defense and before receiving the outcome. Those who had a mock defense are less nervous after the defense and before receiving the outcome (average = 3.22 on a 0–10) than those who had a practice presentation (average = 4.31) or no practice (average = 4.48). Nervousness before and during the defense itself is not related to having a mock defense. Figure 1 illustrates the influence of the type of practice on nervousness before, during, and after the defense. For the boxplots in this paper, the whiskers extend between the minimum and maximum datapoints not considered outliers, where the outliers are plotted individually using the “+” marker symbol. The box indicates the first to third quartile, the red line indicates the median, and the blue circle plots the average (mean) value of the data [36].

Those who had a mock defense rate the overall value of the defense higher (average = 8.01 on a 0–10 scale of overall value of the defense) than those who had a different form of practice (average = 7.17) or no practice (average = 7.20) ($p = 0.051$). Figure 2 illustrates this observation.

In terms of the relation between the type of practice and committee fairness and suitability, we can observe differences across the categories, as shown in Table 3, although only for committee fairness, a statistically significant relation ($p = 0.05$) exists. For those who had a mock defense, a larger percentage of respondents (91.0%) considered their committee fair than for those who had another form of practice (87.5%) or no practice (76.5%). Similarly, we can observe in Table 3 a link between committee suitability and the categories of practice before the defense. A larger percentage of respondents who had a mock defense (82.4%) considered their committee suitable than those who had another form of practice (77.1%) or no practice (79.1%). Combining the observations on committee fairness and suitability, we see for both categories a positive effect for those who had a mock defense.

When it comes to the long-term impact of the defense on student perception in relation to the type of practice, we can observe marked differences between those who had some form of practice (mock defense or other) and those who did not have a practice in advance (see Table 4), although no statistically significant differences between the categories resulted from the statistical test. In particular, a larger percentage of those who had practice (60.3% for those with a mock defense and 68.8% for those with other practice) felt that the defense increased their perception of their academic competence than for those who did not have practice (47.7%). Similarly, a larger percentage of respondents who practiced (35.3% of those who had a mock defense and 35.4% of those who had other practice) report that the defense increased their desire to continue to work in the sphere of their PhD research

than those who did not have practice (26.7%). A larger percentage of respondents who practiced (33.8% of those who had a mock defense and 35.4% of those with other practice) perceived that the defense increased their desire to work in academia, as compared to those who did not practice (19.8%). Finally, a larger percentage of those who practiced (44.1% of those with a mock defense and 43.8% of those without practice) perceived that the defense increased their perceived publishability of their research, as compared to those who did not practice (31.4%).

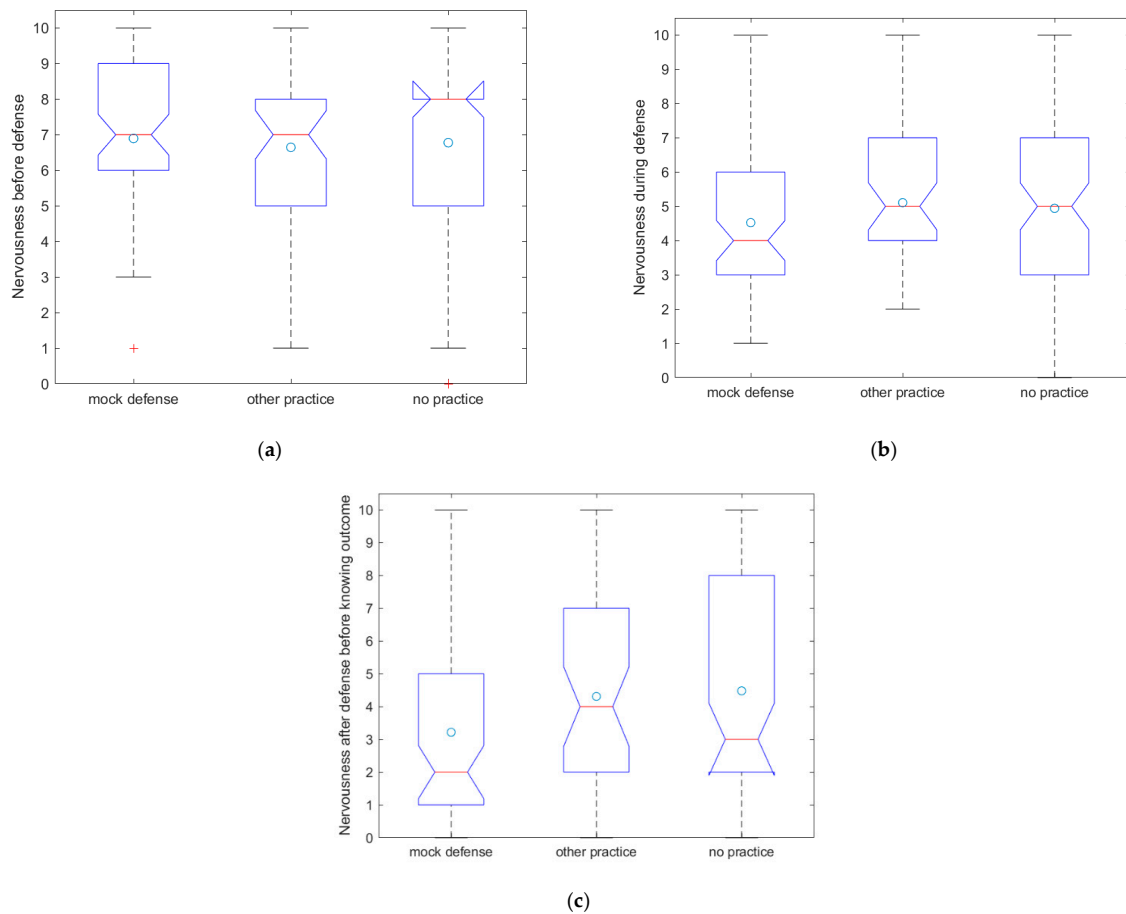


Figure 1. Influence of type of practice before the defense on nervousness (a) before the defense, (b) during the defense, (c) after the defense and before receiving the outcome. $n = 202$. Box plot with median value (red line) and mean value (blue dot).

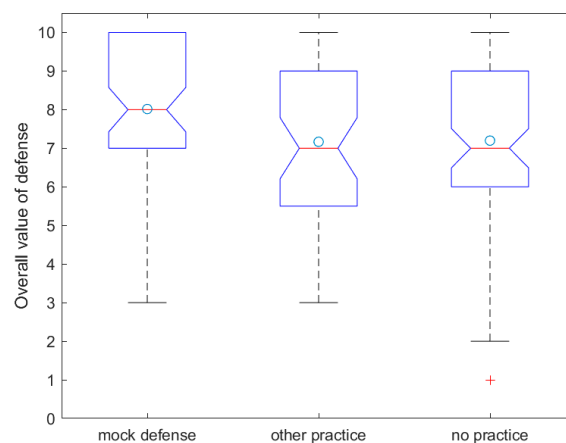


Figure 2. Influence of type of practice before the defense on overall value of the defense. $n = 202$.

Table 3. Committee fairness and suitability by type of practice before the defense.

	Mock Defense	Other Practice	No Practice
<i>Did you consider your committee fair?</i>			
	<i>n</i> = 67	<i>n</i> = 48	<i>n</i> = 85
Yes	91.0%	87.5%	76.5%
To some extent	9.0%	10.4%	22.4%
No	0.0%	2.1%	1.2%
<i>Did you consider your committee suitable for making a well-balanced assessment of your work?</i>			
	<i>n</i> = 68	<i>n</i> = 48	<i>n</i> = 86
Yes	82.4%	77.1%	79.1%
To some extent	17.7%	20.8%	18.6%
No	0.0%	2.1%	2.3%

Table 4. Long-term impact of defense on student perception by type of practice before the defense.

	Mock Defense	Other Practice	No Practice
<i>How did your defense influence your perception of your academic competence?</i>			
	<i>n</i> = 68	<i>n</i> = 48	<i>n</i> = 86
Increased	60.3%	68.8%	47.7%
Not affected	33.8%	31.3%	36.1%
Decreased	5.9%	0.0%	16.3%
<i>How did your defense influence your desire to continue to work in the sphere of your PhD research?</i>			
	<i>n</i> = 68	<i>n</i> = 48	<i>n</i> = 86
Increased	35.3%	35.4%	26.7%
Not affected	57.4%	62.5%	61.6%
Decreased	7.4%	2.1%	11.6%
<i>How did your defense influence your desire to work in academia?</i>			
	<i>n</i> = 68	<i>n</i> = 48	<i>n</i> = 86
Increased	33.8%	35.4%	19.8%
Not affected	55.9%	60.4%	68.6%
Decreased	10.3%	4.2%	11.6%
<i>How did your defense influence your perception on the publishability of your research?</i>			
	<i>n</i> = 68	<i>n</i> = 48	<i>n</i> = 86
Increased	44.1%	43.8%	31.4%
Not affected	44.1%	54.2%	58.1%
Decreased	11.8%	2.1%	10.5%

There is a weak relation ($p = 0.068$) between the enjoyment of the defense and the type of practice. Those who had a mock defense enjoyed their defense more (average = 7.22 on a 0–10 scale) than those who had another form of practice (average = 6.55) or no practice (average = 6.20).

On the other hand, I found no statistically significant relation between the mock defense and the following aspects of defense outcome and perception: the outcome of the defense (passed, minor revisions, or major revisions), perceived importance of the defense, perceived difficulty of the defense, and perceived purpose of the defense.

Bringing together the results of the influence of different categories of practice before the defense on the perception of the students, I conclude that having a mock defense has a moderately positive impact on the perception of doctoral candidates during the defense and long term. From the thematic analysis of the open-ended question on what candidates would have done differently in hindsight, we can also see that some would have wanted their mock defense to be more in line with the real defense. In the presented analysis, I could not distinguish between what candidates considered a satisfactory mock defense versus one that was not properly organized. As such, it is important to stress that for the mock defense to be effective, it has to be executed with care.

4.4. Effectiveness of Preparatory Courses

There is a statistically significant relation between the categories of preparatory courses and perceived importance of the defense ($p = 0.0178$). Those who took a course about the defense perceived the defense as more important (average = 9.45 on a 0–10 scale of perceived importance) than those who prepared with a general PhD course (mean = 7.50) or those who did not take a course (mean = 7.35); see Figure 3a.

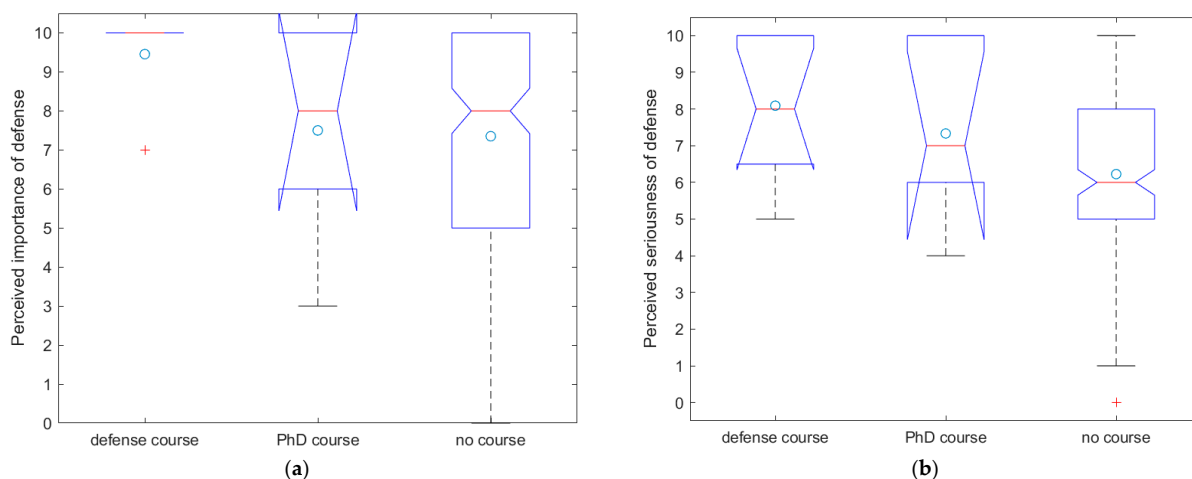


Figure 3. Influence of type of preparatory course before the defense on (a) perceived importance of the defense, and (b) perceived seriousness of the defense proceedings. $n = 202$.

Those who took a preparatory course for the defense perceived the defense as more serious (mean = 8.09 for those who took a course about the defense, and mean = 7.33 for those who took it as part of a general PhD course) than those who did not (mean = 6.23), and this relationship is significant ($p = 0.0343$). This observation is also reflected by the boxplot in Figure 3b. Those who took a preparatory course are thus better aware of the seriousness of the defense, and perhaps less likely to let down their intellectual guard.

When exploring the effectiveness of a preparatory course, the geographic breakdown becomes important. Table 5 shows that it is relatively more common to take a preparatory course in the United Kingdom, where the *viva* determines the revisions of the thesis and where major revisions are relatively more common, than in other countries. This observation may explain the link between a preparatory course and the perceived importance of the defense (Figure 3a): relatively more respondents from the UK participated in a preparatory course, and in the UK the format is such that the defense is crucial in determining the extent of revisions and thus evaluation of the thesis. On the other hand, none of the 32 participants from the Netherlands participated in a course about the defense. In the Netherlands, the thesis is approved by the committee and printed prior to the defense, and failing the defense becomes almost impossible.

Table 5. Breakdown of categories of preparation courses by country of PhD defense, showing only the results from the countries that were most frequently selected.

	<i>n</i>	Course about the Defense ¹	Part of Another PhD Course	No
Belgium	5	0.0%	0.0%	100.0%
Canada	18	5.6%	0.0%	94.4%
France	6	16.7%	0.0%	83.3%
Netherlands	32	0.0%	0.0%	100.0%
Spain	6	0.0%	0.0%	100.0%
United Kingdom	24	20.8%	4.2%	75.0%
United States of America	66	0.0%	6.1%	93.9%

¹ Note that the data in the columns of course categories show the breakdown of the responses per country.

In terms of the perceived purpose of the defense, Table 6 shows the results by category of preparatory course. Percentagewise, more participants who took a course about the defense (44.0%) perceived its purpose as that of an examination as compared to those who took it as part of another PhD course (15.8%) and those who did not take a preparatory course (29.3%). At the same time, percentagewise less participants who took a course about the defense in preparation perceived it as a ceremony (8.0%) or rite of passage (12.0%) than those who took it as part of another PhD course (ceremony = 21.1% and rite of passage = 21.1%) and those who did not take a course (ceremony = 16.1%, rite of passage = 19.9%). This observation can be linked to the defense format and country of the defense, with percentagewise more participants from the UK taking a preparatory course. Since in the UK the thesis is finalized only after the defense, and the defense involves committee members who are called examiners, the defense may have felt more like an examination for a relatively larger share of this group of respondents.

Table 6. Perceived purpose of the defense, by type of preparatory course before the defense.

	Defense Course	PhD Course	No Course
	<i>n</i> = 25 *	<i>n</i> = 19	<i>n</i> = 492
Examination	44.0%	15.8%	29.3%
Ceremony	8.0%	21.1%	16.1%
Celebration	12.0%	15.8%	12.8%
Confirmation	20.0%	26.3%	19.3%
Rite of passage	12.0%	21.1%	19.9%
Other	4.0%	0.0%	2.6%

* Participants were asked to check all that apply, so reported values of *n* are the number of responses of all checked answers together, not the individual respondents.

In terms of the long-term impact of the defense (Table 7), the influence of the different categories of preparatory courses shows a mixed picture, and none of the categories resulted in a statistically significant relation. Relatively more respondents who took a defense course (27.3%) report that the defense decreased the perception of their academic competence than those who took it as part of another PhD course (0.0%) or those who did not take a course (8.1%). When it comes to the desire to continue to work in the sphere of the PhD research, more participants who took a course about the defense (45.5%) report an increase in this desire as compared to those who took it as part of another PhD course (33.3%) and those who did not take a preparatory course (30.8%). Yet, at the same time, more participants who prepared with a module as part of another PhD course report a decrease in the desire to continue to work in the sphere of their PhD research (33.3%) than those who took a course about the defense itself (18.2%) and those who took no course (6.5%).

For the majority of participants, regardless of the category of preparatory course, the defense did not influence their desire to work in academia. Those who took a module as part of another PhD course about the defense report a larger percentage of those whose desire to work in academia decreased due to the defense (16.7%) than those who took a defense course (9.1%) and those who took no course (9.2%). The relation between a preparatory defense course and the perceived publishability of the research is not clear. On the one hand, a larger percentage of those who took a course about the defense perceive that the defense increased the perceived publishability of their research (45.5%) than those who took a module in another PhD course (33.3%) and those who did not take a course (38.4%). Yet, at the same time, a larger percentage of those who took a module in another PhD course (33.3%) report a decrease in the perceived publishability of their research as a result of the defense than those who took a defense course (18.2%) and those who did not take a preparatory course (7.6%).

Table 7. Long-term impact of defense on student perception, by type of preparatory course before the defense.

	Defense Course	PhD Course	No Course
<i>How did your defense influence your perception of your academic competence?</i>			
	<i>n</i> = 11	<i>n</i> = 6	<i>n</i> = 185
Increased	54.6%	50.0%	57.3%
Not affected	18.2%	50.0%	34.6%
Decreased	27.3%	0.0%	8.1%
<i>How did your defense influence your desire to continue to work in the sphere of your PhD research?</i>			
	<i>n</i> = 11	<i>n</i> = 6	<i>n</i> = 185
Increased	45.5%	33.3%	30.8%
Not affected	36.4%	33.3%	62.7%
Decreased	18.2%	33.3%	6.5%
<i>How did your defense influence your desire to work in academia?</i>			
	<i>n</i> = 11	<i>n</i> = 6	<i>n</i> = 185
Increased	27.3%	33.3%	28.1%
Not affected	63.6%	50.0%	62.7%
Decreased	9.1%	16.7%	9.2%
<i>How did your defense influence your perception on the publishability of your research?</i>			
	<i>n</i> = 11	<i>n</i> = 6	<i>n</i> = 185
Increased	45.5%	33.3%	38.4%
Not affected	36.4%	33.3%	54.1%
Decreased	18.2%	33.3%	7.6%

A preparation course about the defense or as part of a larger course about the PhD does not impact the following categories that were studied: the outcome of the defense, the duration of the defense, nervousness before, during, and after the defense, perceived difficulty of the defense, overall value of the defense, and committee fairness and suitability.

Before drawing conclusions from these results, it is important to remark the low number of participants who took a course about the defense: 11 participants took a course about the defense itself and 6 respondents took it as part of another PhD course. The vast majority of respondents (91.6%) did not attend a course to prepare for the defense.

In conclusion, there is no clear positive influence of taking a course on the sentiments during the defense and the long-term impact. However, there are some indications that preparing doctoral candidates for the defense with a course can be positive.

4.5. Effectiveness of Reading about the Defense

There is a statistically significant relation between preparing for the defense by reading and the outcome of the defense ($p = 9.87 \times 10^{-4}$ using a Wilcoxon rank sum test). Surprisingly, however, the results show that a larger percentage of those who did not read about the defense as part of their preparation (74.4%) passed than those who did read (47.8%). This observation can be linked again to the defense format and country (Table 8), and we see that in the UK, where corrections are more common because of the defense format, reading about the defense is more common than in other countries. At the same time, respondents from the Netherlands, where the thesis is approved by the committee and printed before the defense, are less likely to read about the defense as a preparatory step.

When it comes to the perceived importance of the defense, we can find that there is a weak correlation ($p = 0.0727$) with preparatory reading. Those who prepared by reading rated the perceived importance of the defense higher (average = 8.20 on 0–10 scale of importance) than those who did not (average = 7.25); see Figure 4. A potential explanation for this observation is that those who read about the defense in preparation understood better the weight and importance of the event.

Table 8. Breakdown of preparatory reading or not by country of defense.

	<i>n</i>	Yes *	No
Belgium	5	20.0%	80.0%
Canada	18	16.7%	83.3%
France	6	16.7%	83.3%
Netherlands	32	21.9%	78.1%
Spain	6	16.7%	83.3%
United Kingdom	24	45.8%	54.2%
United States of America	66	13.6%	86.4%

* Note that the data in the columns of reading categories show the breakdown of the responses per country.

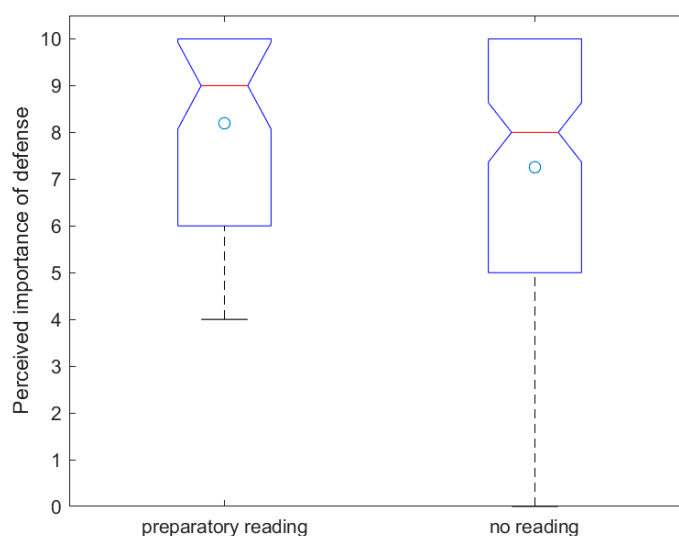


Figure 4. Influence of preparatory reading before the defense on perceived importance of the defense, $n = 202$.

Reading about the defense is not related to: the duration of the defense, nervousness before, during, and after the defense, enjoyment of the defense, perceived seriousness, perceived formality, perceived difficulty, and the overall value of the defense. Moreover, there is no link between reading about the defense and perceived committee fairness and suitability, perceived purpose of the defense, and long-term impact of the defense.

In conclusion, these analyses show that the influence of reading about the defense as part of the preparation does not impact student perception.

5. Discussion

5.1. Discussion of Study Findings

As reflected by the story of the *viva* where the candidate almost failed [5], understanding the purpose of the defense, and the behavior expected from the candidate is an important step in the preparation of the defense. Wellington [20] also observed that some students had erroneous conceptions of the purpose of the defense. Since this type of preparation draws on tacit assumptions of behavior [54], it may not be a tangible aspect of preparing for the defense. Indeed, only two respondents of this study's survey mentioned that understanding the defense proceedings itself was part of their preparation. Doctoral candidates may need more support in terms of understanding the defense format and what is expected during the defense. This preparation can cover both the expectations during in-person and remote defenses, as these have become more common as a result of the COVID-19 pandemic.

One preparatory step that is often cited in the literature [55] is to read the thesis carefully prior to the defense. Failing to know the contents of the thesis may lead to questions about the authorship of the written thesis. The importance of this preparatory

step is reflected in the outcomes of this study's survey. Reading the thesis was the second most frequently mentioned aspect of preparation.

From the outcomes of this study and from the literature review [18,21], I conclude that having a mock defense can have a positive impact on student perception of the doctoral defense. In the research by [20], 25% of the candidates had a mock defense, and in this survey 33.7% of the respondents had a mock defense before the defense. One caveat with the mock defense is that the mock defense requires effort from the department so that an environment can be created that is as similar as possible to the actual defense [18]. While it is not likely that the mock defense itself changes the behavior of committee members (see Table 3), I suspect that there is a link between the good practice of having a mock defense and having good practices in place in terms of committee selection. A potential source of this link could be an involved supervisor, who dedicates time to the preparation of their doctoral candidates prior to the defense, and who is careful in selecting or suggesting committee members.

The analysis of the survey results showed that a preparatory course can help doctoral candidates prepare for the defense, but at the same time sometimes seems to miss the mark. The reason why a course about the doctoral defense does not seem to have a positive effect on the perception of the doctoral candidates is not explored in this study. However, I can speculate about possible reasons. First of all, as indicated in Table 5, there is a link between preparatory actions, country of defense, and thus defense format. As such, the sentiment may be more influenced by the defense format than by the preparatory actions. It is also possible that those who feared the defense most were the candidates who sought out preparatory courses and those preparing for a defense which has a larger weight in the decision on further requested changes to the thesis. Secondly, we observe slightly more positive outcomes for those who took a module about the doctoral defense as part of a general PhD course in some categories. Here, I speculate that those who have been taking a general PhD course have been supported throughout their entire doctoral journey in terms of the process of doing doctoral research, and this support has reflected positively on the sentiment in relation to the defense. In the study by [20], it was clear that students appreciate a preparatory course. For those designing preparatory courses, it is important to align such a course with the format of the defense at the institution. A generic course that is not tailored to the defense format will not help doctoral candidates understand the purpose of the defense and how to best prepare for it. Finally, it is important to note that preparatory courses may be designed with the best intentions in mind, but may miss the mark, as they may not be aligned with the needs of the doctoral candidates, may potentially be compulsory at the institution without the candidate being interested in the course, or may not be updated based on outcomes and feedback of doctoral candidates after the defense. It is important that such courses are aligned with the doctoral defense format, the overall doctoral education program, and that they serve to clarify doubts students may have about the defense.

At the same time, there may be informal ways in which doctoral candidates are getting trained for their doctoral defense. The research culture is often a function of the field of research, with doctoral candidates in the humanities performing a solo endeavor and candidates in the life sciences forming part of larger research teams that carry out experimental work together. The research culture also depends on the department when it comes to collaboration with other doctoral candidates, supervision practices, conference attendance, and the use of research seminars within the department. As such, the research environment may provide at times some form of training towards the doctoral defense, even though explicit preparation for the defense (such as a mock defense) may not be part of the program. Future research should address the influence of the research culture and supervision styles of department on the defense outcome and student perception.

I included reading books, chapters, blogs, and other sources as a category of preparation in this survey, as Share [20] found that 47% of her respondents (in the UK) rely on PhD advice books as a source of information about the doctoral defense. In my study, I found

that 22.8% of respondents, from an international population, consulted books, chapters, and blogs to prepare for the defense. Almost half (45.8%) of the respondents from the UK in this study consulted books, chapters, and blogs, and this percentage is very similar to that found by [20]. I found no indications that preparatory reading is an effective defense preparation measure. A possible explanation of this outcome is that simply looking for information on the doctoral defense online will give a variety of sources. These sources will not all be tailored to the defense format used in the university of the doctoral candidate, and as such may not contain relevant information. For example, looking up advice on how to prepare for the doctoral defense may include the recommendation of summarizing each page of the thesis into one line. This advice works well for those who prepare for the UK-style *viva*, where the examiners may decide to go through the thesis on a page-by-page basis. On the other hand, this advice does not serve those who have a public defense with a large committee asking broad questions as is common in continental Europe. In this example, the information is not in line with the defense format, and thus does not serve as good preparatory information.

5.2. Recommendations for Practice

My recommendation based on this study is for universities individually to assess how they can best support their doctoral candidates towards the defense. Before introducing a general policy of using a mock defense and/or a preparatory course, I recommend running a pilot on a subset of doctoral candidates of a cohort within one semester, for example. After the defense of all candidates, I recommend carrying out an exit interview about the defense and the student's preparation. For the subset who participated in the pilot course, their feedback on the pilot and how it helped them prepare for the defense (or not) should be included as well. With this input, the measures can be evaluated and continually improved to the point where university-wide adoption can become a good policy.

At the same time, it is important to understand that doctoral candidates who are ready to defend are independent researchers. They have spent years developing their methods of planning and executing their research [56]. Offering all candidates the same preparation path may thus be counterintuitive. This observation aligns with what [18] remarked as "*Also, of course, students are highly individual, with each having their preferred ways of approaching the preparation task*". To accommodate for the individual differences, group preparation activities should allow for differentiation, provide a space for the individuals to focus on their particular challenges, and acknowledge the individual needs of doctoral candidates.

A broad approach to preparing doctoral candidates combines university-wide policies for preparation with attention to the individual. An individual approach could consist of an intake meeting with a person from the doctoral school to identify the particular needs of the candidate, which could range from the need to better understand the defense format or the expectations, over a desire to practice through a mock defense, to help dealing with potential anxiety around the defense. In addition, there should also be a space for these preparations where the supervisor(s) can focus on specific aspects of the defense with their candidate.

6. Summary and Conclusions

This article explores how preparing for the doctoral defense impacts the outcome of the defense and the perception of the student about the doctoral defense experience. I studied three aspects of preparation in a quantitative way: having a mock defense, having a preparatory course for the defense, and reading books, blogs, and other sources in preparation for the defense.

The first observation of this research is that preparing doctoral candidates for the defense is not a universal practice. I found that a little over half of the respondents had either a mock defense or another type of practice for the defense. Less than 10% of the respondents attended a course in preparation of their defense: either as a course dedicated to preparing for the defense, or as part of a general PhD course. About a quarter of

the respondents read books, chapters, blog posts, or other sources in preparation for the defense.

In addition, I used open-ended questions to qualitatively analyze how doctoral candidates prepare for the defense, and what they wish they would have done differently. The most common methods doctoral candidates use to prepare for the defense are making the presentation, reading the thesis, and practicing for the defense. About half of the respondents indicated they would not have prepared differently for the defense. Those who would have done something differently in hindsight most commonly state they would have prepared more or would have gone into the defense with a different mindset.

From the quantitative analysis and literature review, I draw the following conclusions with regard to the different types of preparation:

- A mock defense seems to be good practice but requires time and effort to be set up in such a way that it is as similar to the defense as possible.
- A preparatory course can have a positive effect. Proper design of such courses in alignment with the defense format and frequent updating with feedback from the candidates is important here.
- Reading books, blogs, and chapters seems to be less of an effective preparatory measure. While information on the topic is widely available online, the doctoral candidate needs to filter which information is relevant for their defense format.

Based on the analysis of the survey data and the available literature, I can give the following two recommendations:

- Doctoral candidates may need more support in terms of understanding the format of their defense, and what to expect during the defense.
- Universities should explore together with their doctoral candidates and supervisors what would work best to prepare their candidates for the defense. Options include university-wide adoption of measures such as a mock defense and/or a preparatory course, individual paths tailored to the needs of each candidate, and preparation tasks together with the supervisory team.

Topics of future research as outlined by this study to explore are:

- Running a pilot study with a focus group on defense preparation and evaluating the impact of this intervention.
- Comparing the impact of a defense preparation method at various (but a limited number of) universities internationally to better link the efficiency of the defense preparation methods to the defense outcome and student perception as a function of the defense format.
- Evaluating the relationship between supervision practices and defense outcomes as well as students' perceptions of the defense.
- Outlining effective ways in which supervisors can guide their doctoral candidates in the preparation for the defense.
- Comparing efficient defense preparation strategies as a function of the type of doctorate (PhD, Ed.D, or other type of doctorate).
- Using in-depth interviews with candidates to evaluate the link between department culture in terms of collaboration between doctoral candidates, seminars, and conference attendance to defense outcome and student perception.
- Studying the difference in experience in research culture, defense outcome, and student perception as a function of whether the doctoral candidate is part-time or full-time enrolled in the doctoral program.

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