

Motives for Obtaining a Doctorate and Perceived Meaningfulness of Doctorates: A Comparison between Medicine and Life Sciences

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1 **Motives for Obtaining a Doctorate and Perceived Meaningfulness of Doctorates: A**
2 **Comparison between Medicine and Life Sciences**

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17 **Abstract**

18

19 **Background:** In Germany, more than half of the students complete a doctorate in the life
20 sciences and medicine. Thus the doctorate, which is supposed to pave the way for a research
21 career, also seems to perform other functions. In medicine, there is a cliché that students earn
22 doctorates for reasons of prestige but in the life sciences, there is an assumption that you will
23 not succeed on the labor market without a doctorate. To date, we know little about the actual
24 motives for earning a doctorate and its perceived meaningfulness after graduation.

25 **Methods:** Motives for obtaining a doctorate from both subject groups were analyzed using data
26 from the E-Prom study (N = 1518). For medicine, additional data from the Bavarian Graduate
27 Study MediBAS (N = 570) were analyzed. Qualitative interview data from the E-Prom study
28 (N = 28) were used to better understand the motives for obtaining a doctorate in their substance
29 and to compare them with the retrospectively perceived meaningfulness.

30 **Results:** In medicine, the motives of “customariness” and feared “career disadvantages”
31 predominate. Approximately half of the medical doctoral graduates had little or no interest to
32 do research during or after the doctorate. In the life sciences, customariness and feared career
33 disadvantages are important motives, too. However, research (career) interest also receives high
34 and significantly higher approval than in medicine. Moreover, female medical graduates
35 express significantly lower research and career motives; the latter also applies to the life
36 sciences. The qualitative analyzes indicate a close connection between career paths and
37 justifications of meaningfulness of the doctorate in the life sciences. In medicine, justifications
38 of meaningfulness are closely related to initial motives for obtaining a doctorate. Hence, people
39 who only pursued a doctorate to bear a title accordingly justified their doctorate’s
40 meaningfulness merely with its acquisition.

41 **Conclusion:** Our results stress the need for greater promotion of (academic) research careers
42 among medical students, as well as the promotion of female careers in and outside of academic
43 research. Further investigations are necessary to understand the exact mechanisms behind our
44 results and to develop effective interventions.

45

46 **Keywords:** medical doctorate, life sciences, motives for obtaining a doctorate, meaningfulness,
47 early career researchers, academic research careers

48 1. Background and Research Questions

49 The doctorate is a prerequisite for an academic research career and is regarded as proof
50 of qualification for independent research (1). Whereas in many countries the doctorate primarily
51 serves as an entry to an academic career, in Germany the doctorate in many subject areas, in
52 addition to being a qualification for an academic career, also serves as a springboard for a career
53 in the private sector (1-3). This can be explained on the one hand by the large number of
54 doctorates in Germany who exceed the number of available positions in academic research (2,
55 4), and on the other hand by special cultural aspects which make doctorates also desirable for
56 certain career paths outside academia. When comparing the doctoral graduation rates with the
57 available long-term positions in academic research, it follows that doctoral graduates (have to)
58 leave academic research at various points in time. Since the proportion of early career
59 researchers has risen while the proportion of professorships has dropped, the problem has
60 worsened further (4). The proportion of professorships is just under 10 percent, the largest share
61 of employees consists of academic staff on fixed-term and part-time contracts (2, 4).

62 In the life and health sciences, particularly medicine, a high proportion of students are
63 engaged in earning doctorates. As a result, the doctorate is even considered the standard degree
64 in medicine. However, the data on the proportion of doctorates varies widely, with values
65 between 60 and 80 percent (5), mostly in relation to individual institutions. It should be noted
66 here that the professional doctorate does not exist in Germany, i.e., students do not
67 automatically receive an MD (Doctor of Medicine) after completing their studies, but have to
68 compile a thesis that leads to the title of “Dr.med.”. Since the term “doctor” has become a
69 synonym for the term “physician” in everyday language, there may be a fear among medical
70 students that lacking the title of “Dr” might worry patients (6). In addition, a doctorate and
71 postdoctoral lecture qualifications are often a prerequisite for higher positions/careers in
72 (university) hospitals (5).

73 The doctorate rates are also high in the basic subjects of the life sciences (hereafter
74 referred to as “life sciences”); in biology between 50 and 60 percent are stated (7, 8) and even
75 90 percent in chemistry (9). While a relatively high amount of life scientists initially remain in
76 academic research as postdocs, a large proportion of medical doctoral graduates leave academic
77 research (2, 3, 10, 11). This results in the often lamented shortage of physician/clinician
78 scientists (12). Various factors are likely to contribute to this situation: the above-mentioned
79 framework conditions of academic research careers, a lack of research interest, focus on patient
80 care, and/or inadequate training in basic research methodology (6, 12, 13). Since the
81 collaboration between physician/clinician scientists with basic researchers is considered

82 essential for the successful translation from “bench to bedside”, the phenomenon is viewed
83 critically (14).

84 Moreover, the overarching quality of medical doctoral theses has come in for massive criticism
85 and has even gained international attention (15, 16). An impression is created that a majority of
86 the medical students are pursuing doctorates to gain reputation based on the expectations of
87 patients and colleagues respectively, and that scientific progress plays a minor role (5, 17, 18).
88 There already are initial empirical indications of an overall insufficient level of research
89 competences within the scope of the medical doctorate, also when compared to the life sciences
90 (6, 13).

91 However, even in the life sciences, graduates may not only pursue a doctorate out of
92 pure research interest and/or in the pursuit of an (academic) research career. It is often presumed
93 that the lack of job opportunities in and outside of academic research, push life scientists to
94 pursue doctorates and even postdocs (19-21).

95 The reasons why students/graduates begin a doctorate, as well as general work and
96 career attitudes, consequently affect career paths. For instance, links between intrinsic research
97 and career motives (such as a pronounced intrinsic research interest) and the intention to
98 pursue/pursuit of an academic research career have been empirically demonstrated (11, 22-24).
99 Empirical findings on motives for obtaining a doctorate indicate that intrinsic dominate over
100 extrinsic motives (25). However, there are also differences per subject group. In the natural
101 sciences, for example, the motive of customariness applies more often than in other subjects
102 (26, 27). There are also indications that employability is of greater importance in the life
103 sciences. The study by Enders and Bornmann (26), based on data from 1999, showed that in
104 biology the doctorate is more often perceived as a prerequisite for the desired career (cf. *ibid*:
105 52). These results were confirmed in a study by Schmidt (28) for the subject group “chemistry,
106 biology and earth sciences”. In an additional study by Spies & Schute (29), it was found that
107 labor market motives were more pronounced in biology than in mathematics. Due to the age of
108 the analyzed data and partly due to a lack of clear-cut subject categories, there is no current
109 subject-specific analysis of the motives for obtaining a doctorate.

110 Considering the field of medicine, a lower level of intrinsic research interest was shown
111 compared to the life sciences (22). In a further study conducted at five faculties in the federal
112 state of Baden-Württemberg, the majority of respondents stated that they had completed a
113 doctorate out of customariness (30). However, detailed analyzes of motives for obtaining a
114 doctorate in medicine have so far also been lacking.

115 With regard to the perceived meaningfulness of a doctorate – how sensible, i.e.,

116 meaningful, is/was the doctorate and for what reasons – there are only a few institution-specific
117 studies, which question medical doctoral graduates superficially. In these studies, the majority
118 of graduates agree with the general meaningfulness of their doctorate (31-33). However, it
119 remains unclear for what reasons a doctorate is classified as meaningful or less meaningful (13).
120 The qualitative doctoral thesis of Redies (34) deals with the perceived meaningfulness of the
121 doctorate in medicine and comes to the conclusion that this does not always match the
122 institutionally intended purpose of a doctorate, to certify the ability to conduct research
123 independently.

124 Against the above background, we explore the question of why students and doctoral
125 graduates in medicine and the life sciences actually choose to pursue their doctorate. This goal
126 is associated with the question of what doctoral graduates, with subsequent different career
127 paths, subjectively gain from their doctorate. Is the completion of the doctorate perceived as
128 meaningful and why? If not, for what reason? Further, how do the initial motives match with
129 the perceived meaningfulness?

130 We used two quantitative data sets to tackle this question. Data from the E-Prom study
131 were used to analyze the motives for obtaining a doctorate in the life sciences alongside medical
132 students and to compare the two subject groups. As the MediBAS study contained items
133 specific to the field of medicine, it served for an in-depth analysis of the motives of medical
134 graduates. Due to the content overlap of the items in both studies, the analysis of two samples
135 also increases the validity of the results.

136 Based on the qualitative data, we analyze the motives for obtaining a doctorate in more
137 detail and bring them together with respondents' perceived meaningfulness of the doctorate.
138 The comparison between life sciences and medicine, as well as comparisons between genders,
139 are central aspects of our study.

140

141 2. Methods

142 To tackle our research questions, we used data from the E-Prom study, which was
143 collected at the LMU Hospital Munich in cooperation with the Ludwig-Maximilians University
144 of Munich, the Technical University of Munich and the University of Cologne (35) and has
145 been approved by the ethics committee (Proposal 368-14). All study participants signed an
146 informed declaration of consent, which informed them about the use of their data. In addition,
147 we used data from the Medical Graduate Study (MediBAS). The Data of the MediBAS study
148 were collected by the Bavarian State Institute for Higher Education Research and Planning

149 (IHF) in cooperation with the Bavarian Competence Network for Medical Education Bavaria
150 (KMB) (36).

151

152 2.1 Quantitative Samples

153 The MediBAS study was carried out from October 2018 to January 2019. Medical
154 graduates (from human, veterinary medicine, and dentistry) from all Bavarian universities
155 participated. Overall, 613 people took part in the survey. For our analyzes, the data regarding
156 human medicine are relevant (cf. *ibid.*). In addition, people over the age of 45 were excluded
157 from our analyzes because they are no longer considered as early career researchers (2). This
158 leaves a sample of $N = 535$.

159 In addition, the three initial surveys of the doctoral study “E-Prom” with doctoral
160 graduates in medicine and life sciences were used (35). Participants were recruited from 13
161 German universities and received their doctorate from a biological or medical faculty. The
162 surveys were carried out in spring 2014, 2015 and 2016, respectively, with doctoral graduates
163 who had completed their doctorate at a maximum of one year prior to the study. The data set
164 comprises a total of $N = 1,825$ respondents. Doctoral students from the social sciences,
165 humanities, veterinary medicine and dentistry who had earned a doctorate at medical/biological
166 faculties, as well as persons over 45 years of age, were excluded for the purpose of the research
167 questions, so that a data set of $N = 1,432$ was available.

168

169 2.1.2 Operationalization

170 E-Prom study: To analyze the motives for obtaining a doctorate, the participants
171 answered why they had chosen to pursue a doctorate. Based on Berning and Falk (27) fifteen
172 5-point Likert scaled items (1 = completely disagree; 5 = completely agree) were collected
173 (Table A2, Appendix, 37, 38). The data set with the variables used in the following analyzes
174 was made available on the Figshare data repository (39).

175 MediBAS study: In the run-up to the MediBAS study, the items of the E-Prom study
176 were used as a basis for creating a revised, medicine-specific instrument. Twelve 5-point Likert
177 scaled items (1 = completely disagree; 5 = completely agree) were developed, including items
178 such as “I wanted to do a doctorate in order to be perceived as a competent physician by
179 patients” (36). The data are available from the IHF on request.

180

181 2.2 Qualitative Study

182 2.2.1 Sample

183 For in depth analyzes of our research questions, we used qualitative interview data from
184 the E-Prom project. The data and instruments of the study were archived with the consent of
185 the participants and are available to other researchers for secondary analysis (40). As part of
186 the study, ten doctoral graduates plus four doctoral candidates in human medicine were
187 interviewed by telephone in 2014/2015 using a structured interview guideline (13, 22, 40). The
188 respondents were recruited from the quantitative survey of the E-Prom project (cf. *ibid.*). The
189 respondents were selected on the basis of their response behavior to the quantitative survey,
190 thus ensuring that a balanced measure of more and less research interested people was surveyed
191 in both subject groups (22). The qualitative interview study dealt with a wide range of questions
192 in the domains of undergraduate and graduate studies, labor market entry and experiences.
193 Hence, our study represents distinct findings and no duplication of previous publications (13,
194 22, 34). We excluded one social scientist with a doctorate in medicine and a female physician,
195 who did not wish to answer the question of meaningfulness, from our analysis. This results in
196 N = 28 respondents for the present study. The participants' characteristics are described in Table
197 A1 (see Appendix).

198

199 2.2.2 Data Analysis

200 Based on the clearly defined research questions, which were followed up in the
201 interviews, a content analysis according to Mayring was suitable for analyzing the interview
202 material (41). We used the coding scheme developed as part of the E-Prom project as the basis
203 of our analysis. The coding scheme was largely developed in a deductive manner, based on the
204 interview questions and anticipated answer options, and was supplemented inductively with
205 subcategories by assessing the answers of the respondents (34, 40). In the current study, we
206 recoded the relevant text passages and revised the associated category system to achieve a better
207 focus and fit on our research questions (see Table A2, Appendix). First and second author,
208 independently of one another, double coded twenty percent of the interview material (three
209 interviews from life sciences and three from medicine) paragraph by paragraph. For calculating
210 the intercoder reliability (assessed by Cohen's Kappa (42)), the presence of the code was
211 regarded as a match, since the overall classification/categorization of the person interviewed
212 was relevant for answering our research question, whereas the exact location of the code was
213 irrelevant. Cohen's Kappa (42) was determined to be 0.93, which can be considered an almost
214 perfect match (43).

215

216 3. Results

217 3.1 Quantitative Results

218 MediBAS Data: Table 1 shows the motives for obtaining a doctorate of the interviewed
219 medical graduates, agreement in descending order.

220

221 Tab. 1: Motives for Obtaining a Doctorate, Agreement in Descending Order, MediBAS Data

Motives for obtaining a doctorate	N	M	SD
Customariness	534	4.23	0.94
Reputation in the eyes of patients	534	3.73	1.19
Disadvantages in the labor market	532	3.41	1.28
Gain subject-related knowledge	534	3.27	1.33
Keep the option of a research career open	535	3.22	1.51
Societal reputation	535	3.19	1.31
Intensive engagement with the topic of the doctorate	535	3.00	1.38
To better practice evidence-based medicine	534	2.96	1.32
Reputation in the eyes of colleagues	534	2.87	1.36
To research during the doctorate	532	2.75	1.47
To work in research after the doctorate	534	2.44	1.41
Higher income	534	1.99	1.18

Legend: Scale from 1 = completely disagree, to 5 = completely agree, mean values (M) and standard deviations (SD) rounded to the second decimal place.

222

223 The customariness of the doctorate is the motive that clearly receives the greatest
224 agreement. Furthermore, the expected reputation in the eyes of patients and the societal
225 reputation in general are important motives. In comparison, reputation in the eyes of colleagues
226 is less important. Feared disadvantages on the labor market and at least keeping the option of a
227 research career open are also important factors in deciding to pursue a doctorate. Professional
228 development, intensive engagement with the doctoral thesis topic and the subsequent practice
229 of evidence-based medicine are in the middle of the range of motives for obtaining a doctorate.

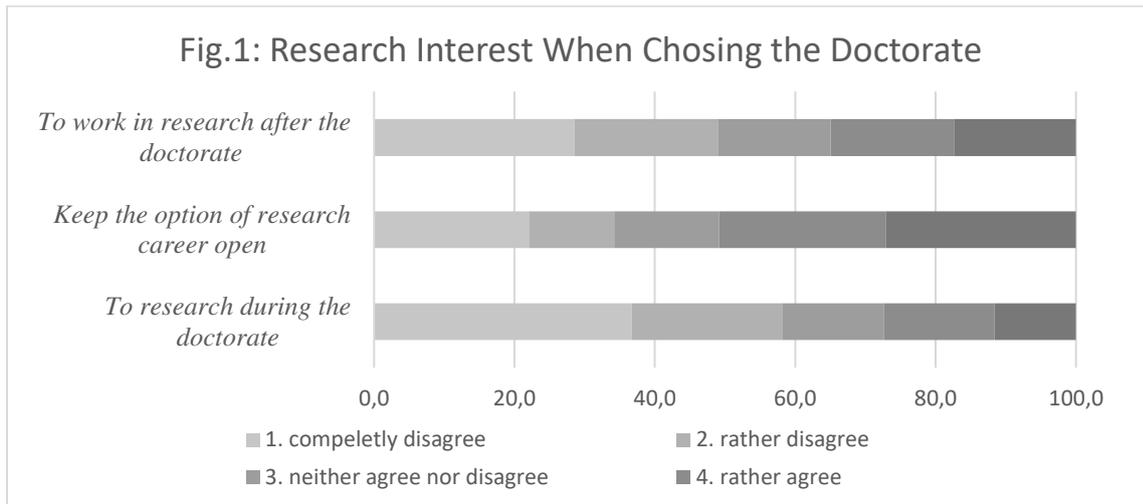
230 Purely research-related aspects, i.e. doing research during the doctorate and continuing
231 to generally work in research after the doctorate, receive medium approval ratings and rank
232 third and second from last in the overall ranking.

233 When considering the distribution of approval to the individual categories, the
234 respondents seem to part into a group of high, and into a group of very low or no interest in
235 research (see Fig. 1): Only about 15 percent of respondents are in the middle approval category.
236 Approximately 50 percent of those surveyed, stated that they did not want to do research during
237 their doctorate, i.e., this was not a motive to start the doctorate (categories “completely
238 disagree” and “rather disagree”). Approximately 60 percent state that working in research after

239 the doctorate was not a motive (Fig.1, Item 3) and about 35 percent were not interested in
 240 keeping their option of a research career open by obtaining a doctorate (Fig.1, Item 2). It is also
 241 interesting that the option of a research career receives higher approval than the motive to
 242 conduct research during and work in research after the doctorate.

243 The possibility of a higher income with a doctoral degree seems to be rather unimportant
 244 and receives the least approval.

245



246

247

248 Table 2 shows the gender comparison. Differences in motives are visible in the areas of
 249 research and career. Female medical graduates attribute less importance to the aspects of
 250 “societal reputation”, “reputation in the eyes of colleagues”, and income when choosing to
 251 pursue a doctorate. Avoiding possible disadvantages on the labor market that may result from
 252 not having a doctoral degree is equally important to male and female medical graduates.
 253 However, keeping the option of a research career open, as well as being able to do research
 254 during their doctorate and to work in research after completing their doctorate, are motives also
 255 rated significantly lower by female medical graduates. In addition, female graduates rate the
 256 motive to better practice evidence-based medicine by obtaining a doctorate significantly lower
 257 in comparison to male graduates.

258

259 Tab. 2: Motives for Obtaining a Doctorate by Gender, MediBAS Data

	Male			Female			p
	N	M	SD	N	M	SD	
Customariness	178	4.23	0.92	342	4.22	0.95	0.979
Disadvantages in the labor market	177	3.49	1.25	342	3.35	1.30	0.257
To work in research after the doctorate	177	2.65	1.45	344	2.32	1.38	0.013
To research during the doctorate	177	2.97	1.50	342	2.61	1.44	0.008

Gain subject-related knowledge	177	3.33	1.37	344	3.19	1.30	0.259
Intensive engagement with the doctoral topic	178	3.12	1.43	344	2.90	1.35	0.094
Keep option of a research career open	178	3.45	1.48	344	3.07	1.50	0.006
To practice evidence-based medicine	177	3.07	1.37	344	2.83	1.28	0.044
Higher income	178	2.34	1.33	343	1.81	1.04	0.000
Societal reputation	178	3.43	1.25	344	3.07	1.32	0.003
Reputation in the eyes of patients	178	3.75	1.23	343	3.73	1.18	0.788
Reputation in the eyes of colleagues	178	3.08	1.34	343	2.74	1.35	0.006

Legend: scale from 1 = completely disagree, to 5 = completely agree, results are based on two-sided t-tests, mean values (M) and standard deviations (SD) rounded to the second, p-values rounded to the third decimal place.

260

261 E-Prom data: In a further step, we compare the motives for obtaining a doctorate from
 262 the E-Prom study by medicine and life sciences (see Table 3 and Figure 2) and by gender (see
 263 Table 4).

264

265 Tab. 3: Motives for Obtaining a Doctorate, Life Sciences and Medicine, E-Prom Data

	Life Sciences			Medicine			
	N	M	SD	N	M	SD	p
Customariness	693	3.93	1.25	739	4.44	0.82	0.000
Improve career opportunities	696	4.36	0.98	730	4.14	1.06	0.000
Gain subject-related knowledge	690	4.19	0.95	730	3.62	1.17	0.000
Intensive engagement with the doctoral topic	686	3.84	1.10	732	3.41	1.26	0.000
To research during the doctorate	692	4.11	1.10	727	2.95	1.41	0.000
Was encouraged by people	684	2.6	1.35	724	2.79	1.42	0.009
To work in research after the doctorate	694	3.92	1.14	731	2.74	1.40	0.000
Higher income	691	3.5	1.33	725	2.18	1.27	0.000
Lifestyle of a researcher	689	2.69	1.35	724	1.93	1.16	0.000
It turned out that way	683	1.96	1.21	721	1.68	1.08	0.000
Work in industrial research	681	2.99	1.26	720	1.68	0.96	0.000
Not wanting to commit to a profession	681	2.59	1.37	727	1.67	1.12	0.000
Flexibility of work and free time	683	2.06	1.17	722	1.33	0.75	0.000
No alternative	690	2.38	1.42	723	1.24	0.69	0.000
Work-life balance	672	1.49	0.86	718	1.19	0.58	0.000

Legend: scale from 1 = completely disagree, to 5 = completely agree, results based on two-sided t-tests. Mean values (M) and standard deviations (SD) rounded to the second, p-values to the third decimal place.

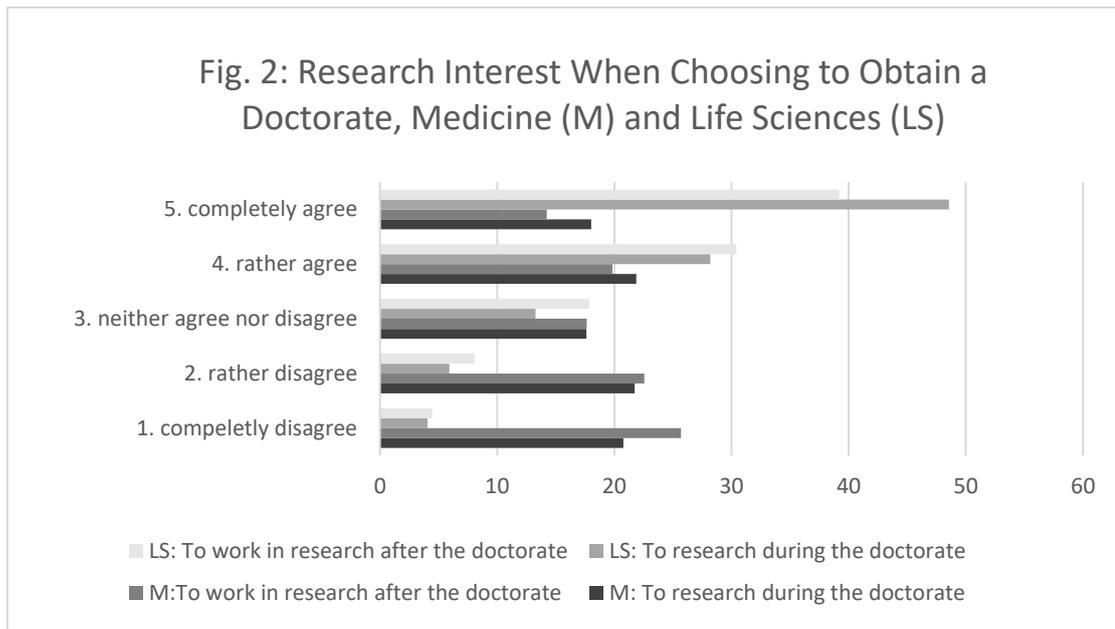
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267 For doctoral graduates in medicine, the data of the E-Prom study, as before, show
 268 customariness of a doctorate as the most important motive for obtaining a doctorate. Items that
 269 represent interest in research attract lower approval ratings in the middle area. Professional
 270 development and intensive engagement with the topic of the doctorate receive higher approval
 271 ratings. Medical doctoral graduates are also hoping for better career opportunities through

272 having the title of “Dr”. The “professional conditions” during the doctorate are of less
273 importance, which is not surprising, since they are mostly conducted during undergraduate
274 medical studies.

275 In the life sciences, customariness is also a strongly pronounced motive but significantly
276 less so than in medicine. In addition to customariness, the most important motives lie in the
277 areas of research interest and development of research competences, as well as in improving
278 career opportunities. All of these motives receive significantly higher approval than in
279 medicine. In particular, the items regarding research during and working in research after the
280 doctorate (also in the private sector), receive significantly higher approval ratings in the life
281 sciences. The motives “professional framework conditions during the doctorate” and “lack of
282 alternatives to the doctorate” receive generally little approval but significantly more in the life
283 sciences than in medicine. In both subject areas, it is rare for a doctorate to “just happen” with
284 the respondents simply not having thought about it much. Interestingly, doctoral graduates in
285 the life sciences agree somewhat more strongly here. Doctoral graduates in medicine are more
286 often encouraged to do a doctorate by a third person.

287 In a further analysis step, we examine the distribution of the approval ratings more
288 closely for the items regarding research orientation. The graphic representation of the
289 categories’ characteristics in Figure 2 clearly shows the difference in research interest between
290 medicine and life sciences. In the life sciences, well over half of those questioned agree with
291 the statements that they decided to pursue a doctorate (also) in order to be able to do research
292 during the doctorate to work in research after the doctorate. The approval ratings here increase
293 steadily from the lowest to the highest level of agreement (see Fig. 2). In medicine on the
294 contrary, the approval ratings in the first and last two categories are almost equally distributed
295 and even tend to fall slightly. As with the MediBAS data, one can see a more or less divided
296 sample of those interested and those (completely) disinterested in research.



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In the next step, we compare doctoral graduates by gender, while still differentiating by subject group (Table 4). We see significant gender differences in medicine, with female doctoral graduates showing slightly higher approval ratings for customariness as a motive and male doctoral graduates showing higher approval ratings regarding the motives to work in research after the doctorate generally and in the private sector.

Female in contrast to male life scientists, have significantly lower approval with regard to the motives wishing to work in the private research sector, lead the lifestyle of a researcher or have a higher income through a doctorate. Customariness as a motive is somewhat more pronounced among female doctoral graduates in the life sciences, as well as the statement that it just turned out that way. Interestingly, work-life balance as part of the doctorate is more important for men, however overall this motive seems to be not important.

Tab. 4: Motives for Obtaining a Doctorate in Life Sciences and Medicine, Compared by Gender

	Life sciences							Medicine						
	Female			Male			p	Female			Male			p
	N	M	SD	N	M	SD		N	M	SD	N	M	SD	
Customariness	421	4.00	1.20	272	3.81	1.33	0.046	470	4.49	0.78	269	4.35	0.89	0.024
To work in industrial research	410	2.90	1.23	271	3.13	1.28	0.018	459	1.61	0.87	261	1.82	1.09	0.005
To work in research after doctorate	420	3.93	1.17	274	3.91	1.09	0.811	461	2.62	1.39	270	2.95	1.40	0.002
Gain subject-related knowledge	418	4.15	0.96	272	4.25	0.95	0.187	462	3.58	1.17	268	3.68	1.18	0.273
To research during the doctorate	421	4.11	1.09	271	4.11	1.12	0.969	461	2.87	1.39	266	3.08	1.43	0.047
Intensive engagement with the doctoral topic	414	3.82	1.09	272	3.87	1.12	0.579	464	3.36	1.27	268	3.50	1.25	0.173
Lifestyle of a researcher	415	2.58	1.31	274	2.85	1.40	0.008	459	1.89	1.12	265	2.01	1.22	0.193

Improve career opportunities	423	4.36	0.98	273	4.37	0.98	0.926	460	4.19	1.04	270	4.06	1.08	0.119
Higher income	418	3.41	1.34	273	3.63	1.30	0.027	458	2.06	1.19	267	2.38	1.37	0.868
Not wanting to commit to a profession	411	2.64	1.39	270	2.51	1.36	0.240	460	1.70	1.15	267	1.62	1.06	0.350
No alternative	419	2.48	1.43	271	2.23	1.40	0.019	458	1.24	0.72	265	1.23	0.64	0.764
Flexibility of work and free time	413	2.00	1.11	270	2.17	1.24	0.064	457	1.32	0.73	265	1.35	0.77	0.588
Work-life balance	410	1.43	0.81	262	1.58	0.94	0.035	456	1.15	0.48	262	1.28	0.72	0.518
It turned out that way	414	2.07	1.23	269	1.78	1.14	0.002	457	1.68	1.08	264	1.68	1.10	0.976
Encouraged by people	416	2.63	1.35	268	2.53	1.37	0.341	456	2.82	1.39	268	2.74	1.48	0.449

Legend: scale from 1 = completely disagree, to 5 = completely agree, results based on two-sided t-tests. Mean values (M) and standard deviations (SD) rounded to the second, p-values to the third decimal place.

311

312

313 3.1.1 Comparison of Research Interested and Disinterested Graduates

314 Next, we analyze whether research interested graduates in medicine and life sciences
315 also differ significantly in terms of their other motives from their colleagues who are rather
316 disinterested in research. Are these, as already shown in other subject groups, “intrinsically
317 motivated and willing to do without” (44)? For this purpose, we formed two groups based on
318 the motives “do research during the doctorate” and “work in research after the doctorate”,
319 respectively with the MediBAS and E-Prom data. People with high approval ratings on both
320 items (“rather agree” and “completely agree”) were categorized as research interested whereas
321 people with (very) low approval ratings in both variables (“rather disagree” and “completely
322 disagree”) were categorized as people disinterested in research. Undecided respondents in the
323 middle category (“partially agree”) were left out for reasons of ambiguity. In addition, the
324 motive to “keep the option of a research career open” was disregarded here, since respondents
325 may have focused more on the career than the research aspect. We compared the attained
326 groups, using two-sided t-tests, regarding their career and prestige orientation but also with
327 respect to the motive of customariness and compared (see Table 5 and Table 6).

328

329 Tab. 5: Comparison of Research Interested and Disinterested, Medicine

	MediBAS Data							E-Prom Data						
	Disinterested			Interested			p	Disinterested			Interested			p
	N	M	SD	N	M	SD		N	M	SD	N	M	SD	
Customariness	227	4.33	0.89	116	4.10	1.03	0.035	235	4.62	0.61	187	4.16	1.08	0.000
Higher income	228	1.86	1.22	116	2.28	1.23	0.002	232	2.10	1.28	187	2.41	1.33	0.016
Improve career opportunities								233	3.93	1.16	186	4.31	0.97	0.428
Reputation in society	229	3.27	1.29	116	3.15	1.42	0.413							

Reputation in the eyes of patients	229	3.90	1.06	116	3.52	1.39	0.043		
Reputation in the eyes of colleagues	229	2.81	1.34	116	2.98	1.47	0.281		

Legend: scale from 1 = completely disagree, to 5 = completely agree, results based on two-sided t-tests. Mean values (M) and standard deviations (SD) rounded to the second, p-values to the third decimal place.

330

331 When comparing medical doctoral graduates who are interested in science and those not
 332 interested (see Table 5), those who are interested in science tend to have a stronger career
 333 orientation: The group of those interested in science shows significantly higher approval ratings
 334 regarding the motives “higher income” and “reputation in the eyes of patients”. This group
 335 agrees significantly less with the customariness motive, although approval remains very high.

336 In the life sciences, the disinterested group who do not agree at all or only somewhat
 337 with the motive of doing research during the doctorate or afterwards is very low (see Table 6).
 338 In medicine, more than half of the respondents in this data set fall into this group (see Table 5).
 339 In the life sciences, there are also no significant differences between the two groups with regard
 340 to career motivations. In contrast to medicine, research interested respondents in the life
 341 sciences agree more strongly to the motive of customariness than those disinterested.

342

343 Tab. 6: Comparison of Research Interested and Disinterested, Life Sciences

	Disinterested			Interested			p
	N	M	SD	N	M	SD	
Customariness	25	3.44	1.36	397	3.98	1.22	0.035
Higher income	25	3.56	1.23	396	3.31	1.31	0.361
Improve career opportunities	25	4.28	1.14	400	4.30	1.00	0.428

Legend: Scale from 1 = completely disagree, to 5 = completely agree, results based on two-sided t-tests. Mean values (M) and standard deviations (SD) rounded to the second, p-values to the third decimal place.

344

345 3.2 Qualitative results

346 The results of the qualitative study are presented below. Because there was a balanced
 347 pre-selection of people more and less research interested, relative and absolute frequencies (as
 348 in any qualitative study) should not be understood as representative (see also Chapter 2.2.1).
 349 Rather, they serve the in-depth analysis of the *content* of motives for obtaining a doctorate and
 350 the perceived meaningfulness of the doctorate. The quotations are freely translated from
 351 German to English by the authors.

352

353 3.2.1 Motives for Obtaining a Doctorate and Meaningfulness, Life Sciences

354 Motives for obtaining a doctorate: When analyzing the qualitative interviews, the
 355 meaning of the motive “customariness” becomes clear: in the life sciences, the high proportion

356 of those obtaining a doctorate, is related to feared career disadvantages without a doctorate.

357 “OK, I honestly didn’t think about it that much at the time. It was clear to me that I would do a
358 doctorate afterwards. On the one hand, because I still could envisage neither an academic
359 career nor something like an industrial research career. On the other hand because I wanted to
360 do it too and because, maybe due to a lack of information, even though I’m still a bit, that in
361 this sector it’s beneficial for most jobs – if not even a requirement – to have a doctorate. So
362 therefore I have never seriously considered not doing a doctorate.” (ID 7, life sciences, section
363 36)

364 Feared professional disadvantages are great motivation for pursuing a doctorate and are
365 cited as a reason by nine of the fourteen respondents (see also Appendix, Table A1). In this
366 context, it is also mentioned that lecturers described a doctorate as an obligatory professional
367 qualification to their undergraduate students. Not only the goal to avoid negative professional
368 consequences, but occupational motives in general are of great importance in the life sciences.
369 A further six respondents mention (the possibility of) a research career as a motive for obtaining
370 a doctorate. Two other respondents named positively formulated professional goals outside of
371 academic research. In addition to a research career, the development of research skills plays an
372 important role which on the one hand can be purely interest-driven but can also be important
373 for a later career, for example also in industrial research.

374 Meaningfulness: Twelve out of fourteen respondents in the life sciences were certain
375 that their doctorate was sensible. The justification of the doctorate’s meaningfulness is related
376 to the current life situation but also to the initial motives for obtaining a doctorate. Those who
377 kept working in academic research see the doctorate as the path leading to the postdoc position,
378 especially if this was a goal from the outset. Postdocs at universities also mention the acquisition
379 of research skills but with only three mentions, this is much less common. The acquisition of
380 research competences is likely not addressed separately as a natural prerequisite for an
381 academic research career.

382 Employees in other professional branches justify their doctorate’s meaningfulness in
383 particular with the acquisition of general skills and personal development (working
384 independently, perseverance, problem solving, etc.), but also state that a doctorate was a
385 prerequisite for their position. If the current professional position does not match the original
386 goal, respondents justify their doctorate’s meaningfulness with possible professional prospects
387 and developments in the future. However, also postdocs in academia emphasize the aspects of
388 general skills and personal development. In addition to professional aspects, these two aspects
389 are, overall, mentioned most frequently (see Table A1).

390 “Yes. I think so. As you have your own project during a doctorate, of course, you learn a lot

391 through that, setting up a project, project management, dealing with other people, er and yes, in
392 any case, of course, you continue to develop. Not just professionally but the soft skills around
393 it.” (ID 8, life sciences, section 161)

394 (laughs) “I now deal differently with a crisis.” (ID 11, life sciences, section 194)

395 Overall, the reputation of having a doctoral title is of little importance here (N = 2).
396 Those interviewees who express uncertainty about their doctorate’s meaningfulness do not
397 differ in in their justifications of meaningfulness. Their uncertainty results from the doubt about
398 whether the doctorate really was a prerequisite for starting a career (ID 3) and due to negative
399 experiences during the doctorate:

400 “Yes, the title makes sense but otherwise, I think the experience is certainly important too, but
401 I wouldn’t call it the most positive time of my life.” (ID 13, life sciences, section 192)

402 Comparison of initial motives for obtaining a doctorate and meaningfulness: If you
403 compare the initial motives (albeit retrospectively) with the assessment of the meaningfulness,
404 the categories coincide very well for the most part. However, there are some interesting
405 deviations. Regarding professional and career aspects, these are equally strongly represented
406 among the motives as well as the perceived meaningfulness in retrospect. It is interesting that
407 research interest or the development of research competences is more common as a motive (N
408 = 6) but rarely mentioned as a justification of meaningfulness in retrospect (N = 3). No clear
409 pattern can be discerned in terms of the characteristics that lead to a mention or non-mention.
410 It is likely that the low attention to this aspect as a justification of meaningfulness is due to the
411 higher focus on the direct transfer of competences acquired during the doctorate into the current
412 professional activity. What also stands out is that the area of or general skills and personal
413 development is only recognized after the doctorate.

414

415 3.2.2 Motives for Obtaining a Doctorate and Meaningfulness, Medicine

416 Motives for obtaining a doctorate: About half of those surveyed in medicine cite
417 research interest or development of research competences as the reason for considering the
418 doctorate as meaningful (N = 7). The primary goal is getting to know academic research in
419 order to include or exclude this for one’s own professional career.

420 “So [not] doing a doctoral thesis, with it being so common in medicine, but I wanted to get an
421 insight into research. And to find out if this is something for me. And beyond that, whether you
422 want to continue at university later on and maybe continue doing research. Or if you can

423 categorically exclude research, then the career path in medicine veers more towards the
424 peripheral institutions rather than university. (...)” (ID 7, Medicine, Sections 59-62)

425 The customariness of a doctorate and the anticipated reputation by bearing a doctoral
426 title play a major role, with five mentions each. Customariness relates to reputation in that a
427 physician without the title might possibly “scare off” patients. Two of the respondents mention
428 customariness without further substantive reasons. This gives the impression of doctorates as
429 more of a habitual choice, possibly based to a lesser extent on cost-benefit considerations (45).

430 “Yeah well, it’s of course common practice in medical studies to actually start during this time.
431 And, for the most part at least, to get it finished. And so of course almost everyone started
432 studying, er, working on their doctorate in the fifth to seventh semesters, and of course I
433 followed suit.” (ID2, medicine, sections 45-47)

434 “Yes, so somehow I thought, that, that it’s part and parcel of it and that somehow was an
435 incentive to get the title. But not, because I’m better regarded among colleagues or something.
436 Not that. So a, a kind of a starting point. Somehow, it was part of it. Cause, I also had friends at
437 university, they all did it, that’s why for me it’s part and parcel of it.” (ID 5, Medicine, Section
438 42)

439 Meaningfulness: Most participants justify their doctorate’s meaningfulness with the
440 acquisition of general skills and personal development (N = 6). Four of the 13 respondents cited
441 the development of research competences as a reason. Two respondents cited the pursuit of a
442 research career, with only one of these respondents sincerely planning one. In addition, two
443 participants justified the meaningfulness of their doctorate by being able to exclude a research
444 career for them personally, as well as the reputation by bearing a doctoral title (N = 2).

445 Comparison of initial motives for obtaining a doctorate and meaningfulness:
446 Respondents, who cited the reputation of the title as only motive for obtaining a doctorate, also
447 justified the meaningfulness only through being able to bear the title. These respondents were
448 also unsure about evaluating the meaningfulness positively. Those who indicated research
449 interest and development of research competences as motives also justified their doctorate’s
450 meaningfulness with the development of research competences, but especially the acquisition
451 of general skills and personal development (34).

452

453 4. Summary and Discussion

454 The present study dealt with the motives for obtaining a doctorate and the perceived

455 meaningfulness of the doctorate in medicine and life sciences. In particular, the question arose
456 as to what extent common stereotypes of the “biologist with no job perspectives” and the
457 “prestige-motivated” medical professional apply. We further examined to what extent research
458 interested and disinterested in both subject groups differ with regard to their career and prestige
459 orientation. In addition, we used a qualitative data to analyze the perceived meaningfulness of
460 the doctorate and the relation between initial motives and (justifications of) meaningfulness.

461 For the life sciences, we found that the customariness of doctorates, which emerged
462 quantitatively as an important motive, largely reflects the fear of experiencing disadvantages
463 on the labor market without a doctorate. However, doctoral graduates also question the truth
464 behind this presumption. Further motives in the life sciences are positively formulated career
465 goals in and outside of academic research, and a desire to develop one’s research competences
466 during the doctorate further. The majority of doctoral graduates in the life sciences are (very)
467 interested in research when choosing to do a doctorate and aim to not only do research during
468 their doctorate, but to continue to work in research after graduation. The comparison between
469 the larger group of research interested with the very small group of those rather disinterested
470 revealed no significant differences in career orientation. It can thus be assumed that a
471 pronounced research interest does not go hand in hand with less pronounced extrinsic motives,
472 as demonstrated in other subject groups (44). Interestingly, research interested respondents
473 agreed more strongly to the motive of customariness, possibly because a research career is only
474 possible with a doctorate. In the life sciences, the meaningfulness of the doctorate is mainly
475 associated with the chosen career path and (hoped for) professional advantages. In addition,
476 great importance is attached to the acquisition of general skills and personal development.

477 In medicine, the customariness of doing a doctorate and, in this context, the societal
478 reputation and reputation in the eyes of patients are important motives for obtaining a doctorate.
479 With regard to research interest when choosing to pursue a doctorate, a clear division emerged
480 between medicine and the life sciences. About half of the respondents from the two samples
481 gave (very) low approval ratings for wanting to do research during or after the doctorate as
482 motives. This gives the impression that a considerable proportion of medical doctoral graduates
483 may have pursued the doctorate for habitual reasons and “following the mainstream”.

484 On the other hand, the acquisition of subject-related skills in the context of the doctorate
485 was of greater importance. It is possible that the doctorate is seen or used as a preparation for
486 further medical education. This assumption should be followed up in further studies.

487 As part of the qualitative interviews, it was found that medical doctoral graduates, who
488 merely wanted to acquire a doctoral degree to bear the title, were hesitant in describing their

489 doctorate as meaningful, and reduced its meaningfulness to the ability to bear the title. Since
490 (justifications of) meaningfulness were not quantified, this result cannot be transferred to the
491 whole group of those who were categorized as disinterested in research. It is interesting,
492 however, that this group was also rather less pronounced in terms of career and prestige
493 orientation. Medical graduates who chose to do a doctorate because of their research interest
494 gave higher approval ratings to the motives “higher income” as well as “reputation in the eyes
495 of patients”. This result could be explained by the fact that for a medical career at (university)
496 hospitals, certain clinical and research duties are expected, so the research sector here attracts
497 those less “intrinsically motivated and willing to do without” (44). This could also explain,
498 medical doctoral graduates affirmed more strongly the motive of keeping the option of a
499 research career open than the motive of working in research after obtaining the doctorate.

500 With the qualitative data, we can show that motives for obtaining a doctorate in both
501 subject areas are closely linked to perceived meaningfulness in retrospect. In the life sciences,
502 there was a strong connection with the current professional situation. Professional aspects play
503 a much more important role in the life sciences compared to medicine, both as regards motives
504 and justifications for meaningfulness. In medicine, the only important professional aspects are
505 the reputation in the eyes of patients and in few instances continuing one’s academic research
506 career.

507 Overall, our analyzes indicate that the development of research competencies and
508 having at least the option to pursue an academic research career after the doctorate play a
509 significantly more important role in life sciences than in medicine. Even when only looking at
510 medicine, conducting research during and after the doctorate rather lag behind as motives to
511 obtain a doctorate in comparison to the other motives assessed. The on average lower
512 competence level following the doctorate in medicine when compared to the life sciences (6),
513 therefore probably can be traced back to differences in research interest *and* in undergraduate
514 and graduate research education.

515 With regard to gender, we find differences in the life sciences but in particular in
516 medicine. In both subjects, female in comparison to male graduates show significantly lower
517 agreement to career motives. In addition, female medical graduates express significantly lower
518 research interest and agree significantly less to the motive of better practicing evidence-based
519 medicine. This raises the question of why female medical professionals in particular are less
520 interested in research than their male counterparts are. In line with these results, a lower
521 research-related self-efficacy among female doctoral graduates compared to male doctoral
522 graduates in medicine (6) and a lower publication activity after completion of the doctorate was

523 found (46). It is conceivable that there is a self-selection bias among the female population of
524 medical students, so that females who exhibit less pronounced career goals (clinical or research
525 related) chose medicine more often as a field of study than females with the reverse profile.
526 However, since the career orientation among females was less pronounced in both subject
527 groups, the reasons for this may be more firmly anchored in society and should be examined
528 separately and comprehensively in further studies.

529

530 Declarations

531 Ethics Approval and Consent to Participate: The ethics committee of the LMU Hospital
532 Munich (Proposal 368-14) approved of the E-Prom study, both quantitative and qualitative.
533 All study participants signed an informed consent. The informed consent signed by all study
534 participants included a consent of publication.

535

536 Availability of Data and Materials: The E-Prom survey dataset was deposited at the repository
537 figshare (doi: 10.6084/m9.figshare.11967741). Qualitative data can be requested from the data
538 repository QualiService (www.qualiservice.org). The MediBAS data can be requested from the
539 Bavarian Institute of Higher Education Research and Planning (www.ihf.bayern.de).

540

541 Conflicts of Interest: The authors declare no conflict of interest:

542

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545

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Appendix

Tab. A1: Description of Participants' Characteristics

ID	Age	Gender	Occupation/ Position	Research Involvement	Motives to Obtain a Doctorate Medicine	Meaningful /Sensible	Justification of Meaningfulness
1	29	m	Assistant physician, university hospital	100%	1) research interest and research competence development 2) (option of) research career	yes	1) research career/engaging in research activities 2) general skills and personality development
2	33	m	Specialist general medicine, medical practice	-	1) customariness	ambivalent	1) general skills and personality development
3	32	m	Research manager, extramural research institution	-	1) research interest and research competence development 2) (option of) research career	yes	1) acquisition of research competences
5	32	w	Assistant physician in dermatology, hospital	-	1) customariness	yes	1) career orientation/exclusion of research career 2) other: pride
6	28	w	Assistant physician orthopedic, hospital	-	1) customariness 2) prestige	ambivalent	1) career orientation/ exclusion of research career
7	28	w	Assistant physician in neurology, university hospital	100%	1) research interest and research competence development 2) (option of) research career	yes	1) acquisition of research competences 2) research career/engaging in research activities
8	33	w	Assistant physician in hemato-oncology, university hospital	100%	1) research interest and research competence development 2) (option of) research career	yes	1) acquisition of research competences
9	27	w	Assistant physician psychology and psychotherapy, hospital	-	1) prestige	yes	1) obtaining title/prestige
10	31	m	Assistant physician neuroradiology, university hospital	Patient care and research	1) research interest and research competence development 2) prestige (here with PhD)	yes	1) acquisition of research competences
11	25	w	Medical student and doctoral candidate	-	1) customariness, 2) research interest and research competence development	yes	1) obtaining title/prestige 2) other: pride
12	22	m	Medical student and doctoral candidate	-	1) prestige, 2) improve career opportunities	yes	1) general skills and personality development
13	22	w	Medical student and doctoral candidate	-	1) research interest and research competence development 2) customariness, 3) prestige	yes	1) general skills and personality development

ID	Age	Gender	Occupation	Amount of Research	Motives to obtain a doctorate	Meaningful /Sensible	Justification of meaningfulness
14	23	m	Medical student and doctoral candidate	-	1) research interest and research competence development	yes	1) general skills and personality development 2) acquisition of research competences
Life Sciences							
1	k. A.	m	Academic research	100%	1) (option of) research career 2) preventing job disadvantages	yes	1) career outside of research, 2) research career/engaging in research activities, 3) prestige
2	29	f	Project manager in industrial research	-	1) research interest and research competence development 2) preventing job disadvantages	yes	1) acquisition of research competences 2) general skills and personality development
3	30	m	Academic research	50%	1) preventing job disadvantages 2) opportunities	ambivalent	1) research career/engaging in research activities, 2) career outside of research (in future)
4	32	f	Administrative assistant in state office	Research related activities	1) preventing job disadvantages 2) (option of) research career	yes	1) general career prospects
5	33	f	Industrial research	Research and development	1) research interest and research competence development, 2) (option of) research career	yes	1) career outside of research
6	34	m	Academic research	100%	1) research interest and research competence development, 2) improve career opportunities	yes	1) general skills and personality development 2) general career prospects
7	34	f	Scientific publisher	-	1) research interest and research competence development, 2) (option of) research career, 3) customariness, 4) improve career opportunities	yes	1) general career prospects
8	33	m	Academic research	100%	1) research interest and research competence development, 2) preventing job disadvantages	yes	1) general skills and personality development 2) acquisition of research competences
9	33	m	Academic research	100%	1) preventing job disadvantages	yes	1) general skills and personality development 2) acquisition of research competences
10	28	f	Academic research	100%	1) research interest and research competence development	yes	1) research career/engaging in research activities

ID	Age	Gender	Occupation	Amount of Research	Motives to obtain a doctorate	Meaningful /Sensible	Justification of meaningfulness
11	29	f	Project manager in industrial research	-	1) preventing job disadvantages 2) given opportunities	yes	1) prestige, 2) general skills and personality development
12	31	m	Software engineer, industrial research	Research related activities	1) customariness, 2) prestige, 3) preventing job disadvantages	yes	1) general skills and personality development, 2) general career prospects
13	32	f	Project manager in industrial research	-	1) preventing job disadvantages, 2) (option of) research career	ambivalent	1) obtaining title/prestige
14	28	f	Academic research	100%	1) given opportunities, 2) (option of) research career	yes	1) acquisition of research competences, 2) research career/engaging in research activities

Legend: all characteristics refer to the time of the interview, m=male, f=female

Table A2: Coding Scheme

Main Categories	Subcategories	Medicine (N)	Life Sciences (N)
Motives to obtain doctorate	Research interest and research competence development		6/14
	(Option of) a research career	7/13	6/14
	Customariness	5/13	2/14
	Preventing job disadvantages		9/14
	Improve career opportunities	5/13	2/14
	Prestige	5/13	1/14
Doctorate meaningful/sensible?	Given opportunities		2/14
	ambivalent	2/13	2/14
Justification of meaningfulness	yes	11/13	12/14
	general skills and personality development	6/13	6/14
	Obtaining title/ prestige	2/13	2/14
	Acquisition of research competences	4/13	3/14
	Career outside of research		3/14
	Career orientation/ exclusion of research career	2/13	
	Research career/engaging in research activities	2/13	5/14
	General career prospects		4/14
	Pride (felt for achievement of doctorate)	2/13	

Legend: overview of coding scheme with absolute frequencies by subject area

Tab. A3: Overview of Quantitative Item Battery, Motives to Obtain Doctorate

I wanted to obtain a doctorate...

E-Prom Study

- because it is very customary in my subject
- to afterwards work in industrial research
- to afterwards work in research (generally)
- to gain subject specific knowledge
- to research during the doctorate
- in order to intensely engagement with the topic of the doctorate
- to lead a researcher's lifestyle
- to improve my career opportunities
- to achieve a higher income
- in order to not having to commit to a profession yet
- due to a lack of alternatives
- to flexibly arrange my work and free time
- in order to have a good work-life balance during the doctorate
- because I was encouraged by other persons
- it turned out that way

MediBAS Study

- because it is very customary in my subject
- to avoid disadvantages on the labor market
- to afterwards work in research (generally)
- to gain subject specific knowledge

to research during the doctorate
in order to intensely engagement with the topic of the doctorate
to keep the option of a research career open to myself
to better practice evidenced-based medicine
to achieve a higher income
to achieve a higher societal reputation
to achieve a higher reputation in the eyes of patients
to achieve a higher reputation in the eyes of colleagues

Legend: original items in German, here freely translated by the authors. Items are assessed on 5 point Likert scale and introduced by the sentence „*I wanted to obtain a doctorate...*“

Figures

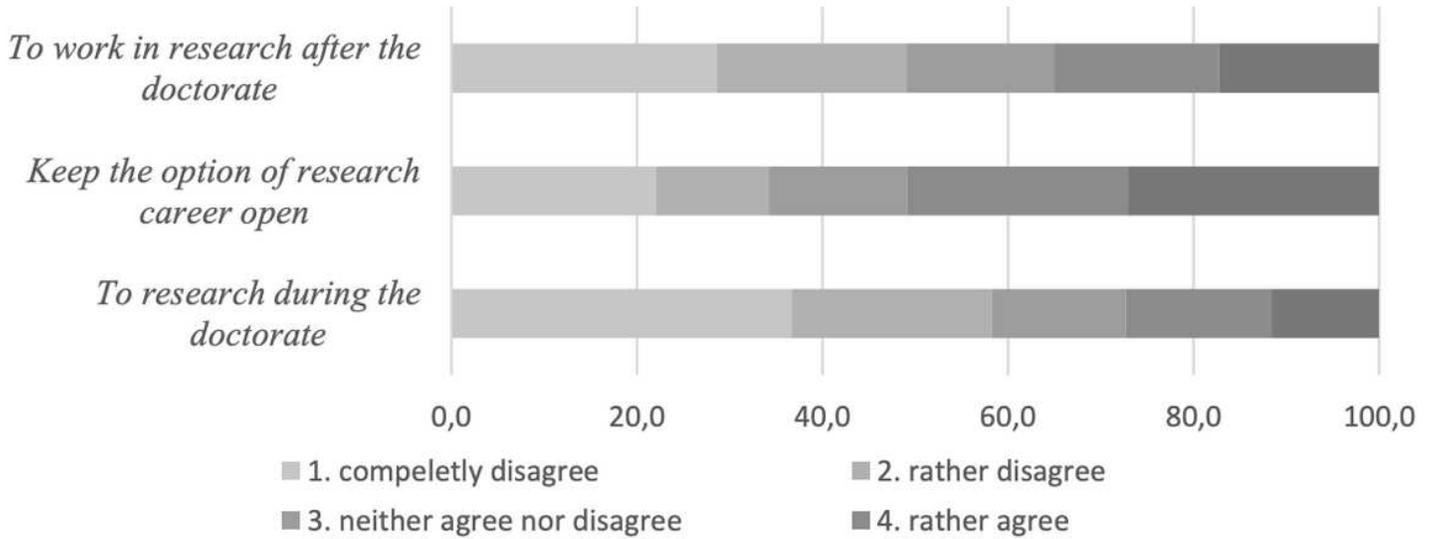


Figure 1

Research Interest When Chosing the Doctorate

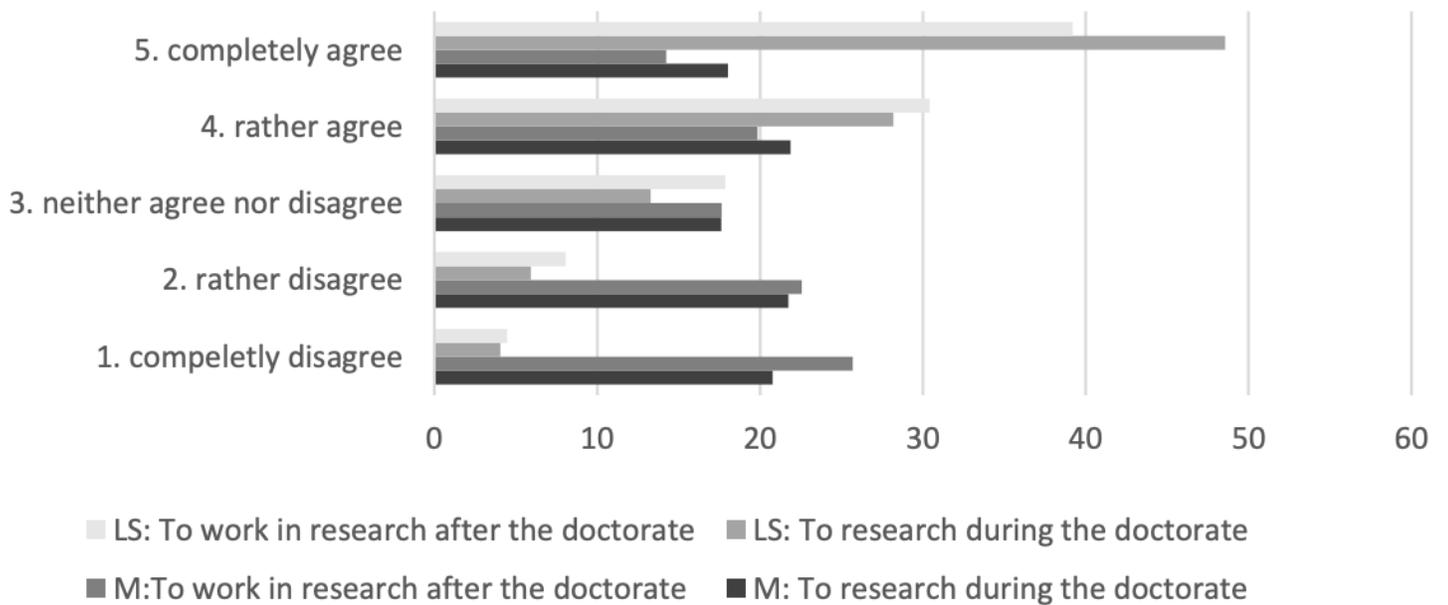


Figure 2

Research Interest When Choosing to Obtain a Doctorate, Medicine (M) and Life Sciences (LS)