



# Who becomes a teacher? Challenging the “negative selection” hypothesis<sup>☆</sup>



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## ABSTRACT

Previous findings on teacher candidates' characteristics seem to support the assumption of a “negative selection” into the teaching profession, with teacher candidates showing less favorable individual characteristics than students in other subject areas. Against the background of current concerns about the supply of high-quality teachers, particularly in the field of science, technology, engineering, and mathematics (STEM), the present research used longitudinal data from more than 1400 students in Germany to compare teacher candidates' demographic, cognitive and personality characteristics with those of students in other subject areas. The study overcomes limitations in prior studies in that it (1) assessed personal characteristics before study entry in order to exclude “contamination” effects, (2) selected an appropriate control group, and (3) differentiated between STEM and non-STEM study majors. The results did not find any empirical support for the negative selection hypothesis in terms of cognitive and personality characteristics in Germany. Instead, vocational interests (especially social interests) emerged as the most important predictor of the enrollment in a teacher education program.

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## 1. Introduction

Teachers have a crucial impact on students' achievement (Hattie, 2009). In fact, it has been argued that the disappointing student outcomes of some countries in international educational assessments can be traced back to the inability of these countries' school systems to attract the right people to the teaching profession (McKenzie & Santiago, 2005; Schmidt, Houang, & Cogan, 2011). As some countries expressed concerns about teachers' competence but also about the supply of teacher candidates the question arises as to whether the “wrong” people are attracted to teaching (Hanushek & Pace, 1995; Krieg, 2006; MET project, 2010; McKenzie & Santiago, 2005). In addition to between-country differences, various studies from several different countries described the recruitment of teachers as a “negative selection”, showing that

teacher candidates show less favorable cognitive and personality characteristics than students in other subject areas (Denzler & Wolter, 2009; Guarino, Santibañez, & Daley, 2006; Hanushek & Pace, 1995). Current concerns about the supply of high-quality teachers particularly referred to study majors in the field of science, technology, engineering and mathematics (STEM) (Hanushek & Pace, 1995; Hanushek, Peterson, & Wößmann, 2013; Krieg, 2006; Schmidt et al., 2011). Although the belief in a negative selection into the teaching profession seems to find widespread acceptance in politics, the public opinion, and several studies, the empirical support for it is far less conclusive. Importantly, most studies suffered from questionable designs that do not allow to separate selection effects from socialization effects, the use of convenience samples, and a lack of differentiating between various different subjects or domains.

The present study aimed at overcoming these limitations. In the present investigation we used longitudinal data of 1463 university students in Germany to compare teacher candidates' cognitive and personality characteristics with the characteristics of students in other subject areas, separately for STEM and non-STEM study majors. We had three general research aims. First, we examined differences in the demographic background, vocational interests, cognitive abilities, and personality characteristics of students with

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study majors in the field of STEM (science, technology, engineering, and mathematics) and students with non-STEM study majors (e.g., language, social sciences, arts). Second, we investigated the personal characteristics of teacher candidates compared to students in other subject areas. Thereby, we considered the study majors by differentiating between STEM and non-STEM. Third, we investigated the relative importance of these characteristics for the decision to enroll in teacher education instead of other subject areas, taking into account whether the students chose study majors in the field of STEM.

### 1.1. Why are certain characteristics important for teaching?

The importance of particular teacher characteristics has recently been described by Kunter et al. (2013). They differentiated between three approaches which all aim to explain how teachers' cognitive and personality characteristics might affect the quality of teaching and thus students' learning. The first, which they call the *bright-person hypothesis* (after Kennedy, Ahn, & Choi, 2008), assumes that stable cognitive characteristics have a direct effect on teaching quality. The bright-person hypothesis is based upon the assumption that teaching is a highly demanding and complex task that requires high cognitive flexibility and the ability to solve problems very quickly (Feldon, 2007). It is consequently suggested that teachers' stable cognitive characteristics are the most determining factors of teachers' success, indicated by a high quality of instruction (Kennedy et al., 2008). In line with this, it is proposed that the best teachers can be characterized by their high intelligence (Kennedy et al., 2008). In a similar way, it is assumed in previous research that stable personality characteristics of teachers have an effect on their professional success and that the best teachers can be characterized by specific personality patterns, like extraversion (Dodge, 1943; Getzels & Jackson, 1963; Rushton, Morgan, & Richard, 2007). Secondly, Kunter et al. (2013) described the *knowledgeable teacher hypothesis* which views profession-specific knowledge as a key factor in teacher success (Shulman, 1987). From this point of view, work-related knowledge and skills acquired in teacher education are more important for later teaching quality than broad and relatively stable characteristics such as cognitive abilities or personality. Third, based on an *offer/take-up-model* (Göbel & Helmke, 2010, 2009), Kunter et al. (2013) suggested that cognitive abilities, motivation, and personality influence teachers' professional success indirectly through the use of learning opportunities during teacher education and in-service teacher training. Thus, individual characteristics such as cognitive abilities, motivation, and personality have an impact on the use of learning opportunities and this in turn influences the development of professional competence (Baumert et al., 2010; Krauss, Baumert, & Blum, 2008; Krauss, Brunner, et al., 2008; Kunter et al., 2007).

Both in the context of the bright-person hypothesis and the development of professional competence, cognitive and personality characteristics are assumed to be crucial for teaching quality. Against this background, it is essential to investigate whether teacher candidates do indeed enter teacher education with less favorable prerequisites than students who choose other subject areas, as postulated by the negative selection hypothesis. Because study programs probably have an impact on cognitive and personality characteristics, it is important to assess these characteristics before students take up their studies. Unfortunately, longitudinal data sets which make it possible to disentangle selection effects from the effects of teacher education programs are rare (see for an exception Gold & Giesen, 1993; Hanushek & Pace, 1995; Stinebrickner, 2001). Although previous research is mostly limited on either cognitive characteristics or personality characteristics and is mostly based on cross-sectional data sets, it can

provide some information on teacher candidates' characteristics and is summarized below.

### 1.2. Individual characteristics of teachers vs. non-teachers: previous findings

Based on general models of career choice as well as profession-specific models of career choice (Ahlqvist, London, & Rosenthal, 2013; Holland, 1997; Lent, Brown, & Hackett, 1994; Rosenbloom, Ash, Dupont, & Coder, 2008; Watt & Richardson, 2007), previous empirical research has mostly focused on the following characteristics of teacher candidates: (1) Demographic characteristics, (2) cognitive abilities, (3) interests, and (4) personality characteristics. In the following sections, recent findings on these characteristics of teacher candidates will be described. Previous research has mainly focused on "the" teaching profession in general. Some studies have considered the teacher education program's academic level (e.g., elementary vs. secondary education). Surprisingly, the study major of the teacher candidates has only been considered in a few recent studies.

#### 1.2.1. Demographic characteristics

Both in the United States and in German-speaking countries, previous research has found that women (52%–80%; Brookhart & Freeman, 1992) and students from homes with a lower socioeconomic status make up the majority in the teaching profession (Brookhart & Freeman, 1992; Denzler & Wolter, 2009; Guarino et al., 2006).

#### 1.2.2. Cognitive abilities

Especially in the US, a large amount of evidence indicated that teacher candidates show less favorable scores in academic achievement and cognitive abilities than students who did not enter teacher education (for a recent overview see Guarino et al., 2006; Hanushek & Pace, 1995; Stinebrickner, 2001). However, the overall difference might mask important differences across subjects, which has not been considered in these studies on characteristics of entering teacher candidates. In fact, about two decades ago, a study by Gold and Giesen (1993) indicated that study major might play an important role. Based on a German sample they showed that a differentiation of teacher candidates according to whether they chose study majors in the field of science or not, explained a significant amount of variance in cognitive abilities. Similarly, in a more recent study, Kaub et al. (2012) reported that German teacher candidates enrolled in the field of science had higher values in spatial sense than teacher candidates with study majors in the field of humanities. Thereby, Kaub et al. (2012) focused on differences within the teaching profession and did not include students in other subject areas in their analyses.

#### 1.2.3. Interests

Individual's interest in different occupational activities is seen as a broad personality characteristic and as an important factor in the context of vocational choices (Holland, 1997). Previous research from different countries predominantly showed that teacher candidates are characterized by high social interests and motives (e.g., listening to someone's problems, teaching or educating; Denzler & Wolter, 2009; Klusmann, Trautwein, Lüdtke, Kunter, & Baumert, 2009; Neugebauer, 2013; Watt et al., 2012). Again, concerning differences within the group of teacher candidates, Kaub et al. (2012) showed that German teacher candidates enrolled in the field of science had higher realistic (e.g., working with a machine, investigating something's functional capability) and investigative interests (e.g., reading scientific articles, engaging in something unexplored) as well as lower artistic (e.g., writing stories and

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