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Motivational, Personal and Cognitive Prerequisites of Pre-service Teacher Candidates

– A Systematic Analysis of Application Documents

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Admissions procedures to teacher education programmes are traditionally dominated by cognitive criteria. Until now, there is little knowledge about how to use alternative, profession-relevant non-cognitive criteria in the context of university admissions procedures. This study investigates the prerequisites of pre-service teacher candidates by systematical analyses of application documents: Content analyses of letters of motivation give information on study motives. Curricula vitae are used to assess previous experiences in pedagogical fields and final school grades serve as cognitive criteria. A descriptive overview of the prerequisites of a complete cohort (N = 238; winter term 2011/12) of pre-service teacher candidates is given. Cluster analysis reveals five distinct groups with excellent to critical prerequisites for the teacher profession.

Key words: Teacher Education Admission Procedure, Profession relevant Non-Cognitive Criteria, Cluster Analysis

1. Introduction

Student selection has internationally become a very topical theme in the tertiary education sector. This development is caused by greater numbers of students and a growing competition between universities to attract the

best candidates. Student selection for teacher training programmes inherits a further relevance: "teachers make a difference" (Wright, Horn & Sanders, 1997, p. 57) in students' learning. Teacher effects are revealed as the most dominant factor in student gain (ibid.). As the teacher's personality is considered to be changeable only to a limited extent (Mayr, 2011), selecting the right people for teacher training programmes is a highly responsible task.

The topic of student selection is treated in various ways across different countries, universities and faculties. However, there is a common trend towards the diversification of admissions requirements and criteria (Heine et al., 2006). Standardized test scores and high school achievements, especially scholastic assessment test (SAT) scores and high school grade point averages (HSGPAs), are traditionally used for college admissions (Schmitt, 2012; Schmitt et al., 2009). For example, in Germany HSGPAs are used in 81.4 % of German higher education institutions. It is the most commonly used admissions criterion (Spiel, Litzenberger & Haiden, 2006). Only recently, the inclusion of non-cognitive factors "to provide a more holistic view of student potential" (Schmitt, 2012, p. 18) is growing. However, there is a lack of valid instruments which allow adequate student selection (Tarazona, 2006). Compared to other professional fields such as medicine, there is little research on admissions to teacher education programmes (Smith & Pratt, 1996). Consequently, there is no agreement among practitioners and researchers about relevant criteria and their measurement.

In order to find out more about admissions to teaching, the TUM School of Education (*Technische Universität München*, Germany) established a research project to evaluate various aspects, including selection interviews, of its admissions procedure to the teacher training programme. In contrast to earlier research, we focus on a complete cohort of potential student teachers. This sub-study focuses on pre-service teacher candidates' cognitive and non-cognitive prerequisites and forms the basis for further research on the students' development during their studies. Our approach is a systematic analysis of application documents of a complete cohort (N = 238) of pre-service teacher candidates. Although many universities demand extensive application dossiers, their use as predictors of study and vocational success has hardly been investigated. Our research questions are: (1) What information can be gained from systematic analyses of pre-service teacher candidates' application documents? (2) Which clusters of pre-service teacher candidates' prerequisites can be identified based on this information?

2. Theoretical framework

2.1 Aptitude testing for teacher education programmes

There are two different research paradigms which serve as a basis of argumenttation for selective access and the consideration of non-cognitive criteria in admissions to teacher education programmes.

Firstly, there is a body of research on the *teaching personality* which gives evidence for the significance of stable personality traits for (a) teaching quality, and (b) teachers' health. Studies on the teacher's personality are often based on McCrae and Costa's (1987) five-factor model (FFM) of personality. Although there are several studies which report positive interrelations between the quality of teaching and several facets of the FFM (e.g. Emmerich, Rock & Tarpani, 2006), the findings are often contradictory. Findings on teachers' health are more obvious. Compared to other professional groups, teachers show striking tendencies to burn-out (Schaarschmidt, 2007). This indicates a misfit between the profession's high requirements and the suitability of some teachers. Many studies report positive correlations between neuroticism and burnout (e.g. Foerster, 2006; Kokkinos, 2007) as well as neuroticism and teachers' lack of job satisfaction (e.g. Urban, 1992). In contrast, extraversion has a positive impact on both variables (Lipowsky, 2003; Mayr & Neuweg, 2006). As personality characteristics turned out to be relatively stable (Mayr, 2011; Roberts & DelVecchio, 2000), it is striking that Schaarschmidt (2004) revealed unfavourable personality patterns for 40 % of pre-service teachers. Aptitude testing before study entry could prevent unsuitable persons from entering the profession and foster suitable persons to become teachers.

Secondly, research on the *professional development of teachers* argues that teachers' learning processes are fostered or impeded by more or less favourable prerequisites. The so-called integrative perspective on teacher development (e.g. Kunter et al., 2011; Mayr, 2010) emphasizes that individual prerequisites such as cognitive, motivational and personal factors moderate the way in which learning opportunities are noticed and utilized. This accounts for both academic and practical contexts. In summary, teacher education programmes are more or less efficient depending on the students' prerequisites. As a consequence, some researchers and practitioners claim that if developmental needs seem to be unbridgeable, the admission to teacher education should be questioned.

2.2 Why school grades are insufficient as admissions criteria for teacher training programmes

Until now, the admissions procedures to most study programmes are dominated by cognitive criteria. Usually, the candidates' high school grade point average (HSGPA) is used as the single criterion or it is combined with other criteria (Heine et al., 2006). Such cognitive measures can be applied objectively and efficiently to a large number of college applicants and allow comparability across students with varying educational backgrounds (Schmitt et al., 2009). Its application is well accepted. HSGPAs correlate comparatively well with academic grades (e.g. $r = .41$; Robbins et al., 2004) and currently constitute the best predictor for study success (Gold & Souvignier, 2005; Rindermann & Oubaid, 1999). However, as substantial parts of variance remain unexplained, their use as an exclusive admission criterion is questioned (Stemler, 2012). Furthermore, academic grades do not correlate very well with other aspects of academic success (e.g. student satisfaction, engagement or study duration) or job performance (Cappelli, 1991). On the basis of statistical simulation studies, Müller-Benedict (2010) argues that the accuracy with which school grades are used for allocating university places does not relate to its expressiveness.

Beyond this rather general criticism, the transferability of common findings in research on aptitude testing to the teacher domain is questioned for two reasons (Blömeke, 2009). Firstly, teacher training programmes are comparably heterogeneous (ibid.). Besides two or more different subjects, the programme also includes didactic and educational-psychological content as well as practical phases. This explains why correlations between HSGPAs and final university examinations were much weaker in a sample of mathematics teachers ($r = .23$) compared to a sample of diploma mathematicians (corresponds to the Master's degree; $r = .43$; ibid.). Secondly, as the teacher profession is a well-defined occupation and the vocational demands are known, it is improper to consider only academic success criteria within admissions procedures. Apart from that, school grades revealed as insufficient in predicting teachers' self-reported occupational success (Mayr, 2010). In summary, the usage of school grades as the single admissions criterion for teacher training programmes seems unsatisfactory.

2.3 Alternative criteria relevant for academic success

Whereas a large amount of earlier research assumed that student achievement depends on general cognitive ability (Sternberg & Grigorenko, 2002), recent studies show that measuring a broader range of abilities accounts for more incremental variance (e.g. Stemler, 2012). Current studies highlight the benefits of non-cognitive predictors. Crede and Kuncel's (2008) meta-analysis, for example, revealed study habits and skill measures to be strong predictors of academic success. However, personality traits and motivational aspects still play a minor role in research on aptitude testing (Blömeke, 2009). Stemler (2012, p. 12) points out that

> […] despite the promise of these new and broader measures of ability, none are yet sufficiently refined for administration at the large-scale level of hundreds of thousands of students, and evaluating further data on their utility at this scale is advisable.

Until now, there has been no consensus about which prerequisites pre-service teacher candidates should have before study entry. The choice of predictors depends largely on the criteria to be predicted. Objective success criteria (e.g. academic grades) can best be predicted by cognitive indicators (e.g. HSGPAs), whereas subjective success criteria (e.g. student satisfaction or job satisfaction) can best be predicted by psychological and motivational predictors (Blömeke, 2009). Based on theoretical knowledge and empirical findings, Blömeke (2009) suggests using three bundles of admissions criteria – including subjective and objective predictors – in order to predict teachers' study and occupational success reliably: these are *cognitive criteria*, *motivational criteria* and *person-related criteria*. This classification is supported by German nationwide educational standards (Kultusministerkonferenz, KMK, 2004) and Kunter and colleagues' (2011) model of professional development.

In the following, we rely on the three bundles *cognitive*, *motivational* and *personal prerequisites* as potential dimensions for admissions procedures in the teacher domain. The next sections summarize empirical findings on the predictive validity of these dimensions for various academic and occupational success indicators. The findings are reported either from general working contexts or, if available, from teacher research.

Cognitive prerequisites. Scholars widely agree on considering cognitive ability as a necessary condition for both academic and occupational achievements. Numerous national and international empirical studies have

confirmed good to excellent validities of school grades in predicting academic grades (Robbins et al., 2004; Trapmann, 2008). Apart from school grades, Trapmann (2008) found significant interrelations between cognitive achievement tests and academic grade criteria, study duration as well as the non-cognitive criterion satisfaction with stress coping. A meta-analysis by Gottfredson (2003) revealed the factor general cognitive ability (*g*) to be the best predictor for job performance. Performance predictions based on general cognitive ability turned out to be more reliable than predictions based on specific skills and abilities (ibid.). Overall, the importance of cognitive criteria is considered verified for various academic and occupational achievement criteria.

Motivational prerequisites. Current research on students' achievements highlights "the contribution of both motivational and cognitive factors for student academic success" (Linnenbrink & Pintrich, 2002). Researchers' understanding of student motivation has changed from a single global construct to a multifaceted one. According to Linnenbrink and Pintrich (2002), the four motivation facets self-efficacy beliefs, adaptive attributions, intrinsic motivation and adaptive goal orientation are most relevant to learning in academic and other contexts. There are numerous empirical studies which underline the relation between students' motivation and their achievements. Blömeke (2009), for example, found significant negative correlations between mathematics teachers' interest in mathematics and their study duration (r = -.11) as well as their intention to dropout (r = -.17), but positive correlations concerning the teachers' job satisfaction (r = .16). Subject-specific study motivation reduces the intention to dropout (r = -.18) and stress experience (r = -.13) and fosters students' results in terms of university exit exams (r = -.23[1]). Regression analyses by Fellenberg and Hannover (2006) revealed subject-specific interest to be the strongest predictor for the intention to abort studies (β = -.43). In a meta-analysis, Credé and Kuncel (2008) identified study motivation as a strong predictor (p = .39) of freshman GPAs. Furthermore, study motivation showed incremental validity over HSGPAs in predicting academic performance.

Especially in teacher research, a qualitative differentiation of motivational aspects, e.g. intrinsic versus extrinsic motivation, is reasonable. There are a variety of studies which describe teacher aspirants' study motives (e.g. Pohlmann & Möller, 2010; Retelsdorf & Möller, 2012; Rothland,

[1] In the German educational system high grades are classified as good achievements, whereas low grades mean poor achievements. For this reason the cited interrelation is negative.

2011). However, there has been little research investigating the relationship between teacher aspirants' study motives and performance-related criteria. The few existing studies reveal contradictory results. Albisser, Kirchhoff and Albisser (2009) did not find correlations between teachers' vocational motivation and their experience of stress. Künsting and Lipowsky (2011) found intrinsic motivation to predict student teachers' self-reported strategy use ($ß = .34$) and their satisfaction with the study programme ($ß = .49$), whereas extrinsic motivation did not correlate significantly with these criteria. Concerning occupational success, the predictor achievement motivation is considered to be essential to occupational success (Amelang & Schmidt-Atzert, 2006). In sum, there is strong empirical evidence which attests medium correlations between motivational criteria and academic and vocational outcomes.

Personal prerequisites. Research on the teaching profession as well as theories from work and organizational psychology stress the role of personality traits besides cognitive and motivational characteristics in predicting teachers' occupational success (Blömeke, 2009). As personality characteristics are considered to be relatively stable (Mayr, 2011; Roberts & DelVecchio, 2000), their relevance for aptitude testing is obvious.

Künsting and Lipowsky (2011) showed that conscientiousness predicts student teachers' satisfaction with their study programme ($ß = .13$) and their use of strategies ($ß = .47$) significantly. In contrast, neuroticism turned out to have a negative effect on student satisfaction ($ß = -.26$) and no significant interrelation with use of strategies. Among other criteria, Fellenberg and Hannover (2006) investigated first year students' general and subject-related self-concept and found strong correlations with their intention to dropout ($r = -.22$; $r = -.39$). In a subsample of $N = 130$ students of MINT subjects, these interrelations were even higher ($r = -.31$; $r = -.48$).

The personality trait instrumentality showed clear effects on both various academic (final university examinations: $r = -.15$; intentions to dropout: $r = -.11$; stress experience: $r = -.19$) and self-reported occupational success criteria (adequate job position: $r = .11$; job satisfaction: $r = .15$; Blömeke, 2009) in a mathematics teachers sample. Fairly similar but generally weaker correlations were found concerning the personality trait expressiveness. Keller-Schneider (2009) identified six beginning teachers' profiles based on the Big Five personality traits. Within these profiles, extraversion and neuroticism were meaningful predictors of coping with occupational stress. A retrospective survey by Mayr (2007) revealed extraversion, consciousness and partly openness as suitable long-term predictors of teachers' occupational learning and consequently various pedagogical competencies.

Urban, Reisinger and Samac (2010) found similar results for a sample of $N = 540$ student teachers: the personality traits consciousness, neuroticism and extraversion as well as shyness, together with divergent thinking were able to explain 75,5 % of variance of profession-relevant competencies. In contrast, years of teacher experience do not influence the relationship between personality measures and quality of teaching significantly (Emmerich, Rock & Tarpani, 2006). In summary, there are a number of studies which reveal significant but rather small or medium-sized effects between personality scales and (prospective) teachers' success.

There is no consensus yet about the use and measurement of personal prerequisites in the context of university admission. Insufficient predictive power and measurement errors keep practitioners from using personality tests as authoritative admissions criteria. Alternatively, Smith and Pratt (1996) suggest the use of biographical data in admission to teaching. Prior life experiences are considered empirically and conceptually as strong predictors of job performance (Cappelli, 1991). It was already shown that the quantity and quality of student teachers' previous experiences in pedagogical fields interrelate with interests for teacher-specific tasks (Mayr, 1998; Nieskens, 2009). However, in order to use biographical data as admissions criteria, more research is needed (Smith & Pratt, 1996).

After having given evidence for the relevance of cognitive, motivational and personal factors for teachers' academic and occupational success, we describe this study's operationalization of these variables.

3. Methodology

3.1 Sample

Our sample consists of a complete cohort of pre-service teacher candidates ($N = 238$) who applied for the winter term 2011/12 to the TUM School of Education. Each application which was completed within the application deadline (15th July 2011) is considered. $N = 149$ (62.6 %) females and $N = 89$ (37.4 %) males applied for the teacher training programme. The applicants' mean age was $M = 19.55$ ($SD = 2.39$) years. The TUM School of Education's teacher training programme ends with a Bachelor's degree (Bachelor of Education) and educates teachers in the following subject combinations for teaching in grammar school: biology/chemistry (42.4 %), mathematics/physics (23.9 %), mathematics/sports (15.5 %), mathematics/chemistry (13.0 %), mathematics/informatics (5.0 %).

3.2 Operationalization of variables

This study's approach is a systematic analysis of pre-service teacher candidates' application documents. Applying at the TUM School of Education requires the certificate of having passed the Abitur[2], a letter of motivation (free from requirements concerning format or content) and a curriculum vitae. If existing, applicants can add documents and certificates attesting special commitment at school, internships, engagement in sports clubs or other extracurricular activities. The application documents were used to operationalize the pre-service teachers' cognitive, motivational and personal prerequisites. *Table 1* gives an overview of the obtained variables.

Dimension	Indicator	Data source
Cognitive prerequisites	HSGPA	Certificates of having passed the Abitur
	Corresponding subject choice in upper school and university	
Motivational prerequisites	Intrinsic study motives	Letters of motivation
	Social influences Extrinsic study motives	
Personal prerequisites (pedagogical experiences)	Private tutoring	Curricula vitae, official documents & certificates
	Didactical experiences School-related experiences Socio-educational experiences	

Table 1: Overview of the obtained variables.

Applicants' certificates of having passed the Abitur give information on HSGPAs and courses taken in upper school. We used HSGPs as indicators for the applicants' cognitive ability. Furthermore, we proved if subject choices in upper school correspond to one or both of the chosen teaching subjects. A corresponding subject choice indicates solid previous knowledge.

Although their usage has increased, universities widely vary in their evaluation of letters of motivation (Schmitt et al., 2009). Consequently, we induc-

[2] German university entrance qualification.

tively developed 18 categories to analyse the pre-service teacher candidates' study and career choice motives. We identified three supergroups: intrinsic study motives (e.g. interest in working with youth and kids, subject-related interest), social influences (e.g. parent is teacher, role model teachers) and extrinsic study motives (e.g. financial reasons, reconciling work and family life). Individual text passages were coded with the help of the software MAXQDA (version 10). 50 % of the letters of motivation were coded by two raters to ensure interrater reliability. As Cohen's Kappa κ cannot be interpreted for variables with unsymmetrical marginal distributions (Wirtz & Caspar, 2002), which applies to all our variables, we used alternative indicators: Percentage agreements were calculated separately for the cases with at least one coding and cases with no coding in the corresponding category. Systematic interrater agreement is given if the percentage agreements differ clearly from the coincidental agreements *and* if Cohen's Kappas κ is revealed as significant (ibid). This is given for all of our variables.

We used biographical data (Smith & Pratt, 1996) gained from curricula vitae as well as from certificates and documents as indicators for the applicants' previous experience in the pedagogical field. We assume that pedagogical experience gives persons the chance to self-check the fit between their personal abilities and specific demands of the working field and thus enable adequate occupational choices. We categorized the biographical data into four different categories to distinguish the type of pedagogical experience: giving private tutoring lessons to other students, didactical experiences in school or tuition institutes, school-related experiences (e.g. special engagement as class representative or internships at school) and social pedagogic experiences (e.g. training children in sports or leading youth groups). Information gained from curricula vitae and certificates were coded into the same categories. As only 28.2 % ($N = 67$) of the pre-service teacher candidates included certificates which (partly) prove their pedagogical experiences, most data were gathered from curricula vitae.

3.3 Statistical methods

We used descriptive statistics and frequency tables to give an overview of the pre-service teacher candidates' prerequisites. Two-step cluster analysis was used to identify generalizing clusters based on selected variables. The aim of cluster analysis is to distinguish a set of objects into several groups by allocating similar objects to the same cluster and allocating considerably differing objects to different clusters (Brosius, 2011). Two-

step clustering allows the inclusion of continuous and categorical variables and automatically determines the optimal number of clusters (Schendera, 2010). Log likelihood was used to measure distances between the cases. Schwarz's Bayesian Criterion (BIC) serves as clustering criterion. All analyses were conducted with the help of the statistical software SPSS (version 20).

4. Results

In this section descriptive statistics are listed for all variables (*sections 4.1 to 4.3*). Some of the obtained variables were used for cluster analysis (*section 4.4*).

4.1 Cognitive prerequisites

The applicants' HSGPAs varied from 1.0 to 3.6, with 1.0 being the best and 4.0 the worst possible average grade. It was $M = 2.11$ ($SD = .55$) in mean. 39.5 % ($N = 94$) of the sample had "very good" (1.0 – 1.9) HSGPAs, 52.5 % ($N = 125$) had "good" (2.0 – 2.9) and 8.0 % ($N = 19$) had "satisfying" (3.0 – 3.9) HSGPAs. In 60.1 % ($N = 143$) of the pre-service teacher candidates at least one of the upper school major subjects corresponds to one of the teaching subjects[3].

4.2 Motivational prerequisites

The word count of the letters of motivation was $M = 349$ ($SD = 218.49$) on average and varied greatly ($Min = 43$; $Max = 1584$). One letter of motivation was a blank document and so was excluded from the analyses ($N = 237$). *Figure 1* gives an overview of the most frequently named study motives within the three supergroups intrinsic study motives, social influences and extrinsic study motives. Within the intrinsic study motive, we differentiated between statements about the applicants' interests (e.g. "I am interested in teaching.") and their self-concepts (e.g. "I am good at teaching.") in some variables. Statements about subject-related interests, for example, were reported by 94.1 % of the sample and didactical interests by 75.9 %.

[3] This percentage is mainly caused by the subject mathematics, which is a compulsory subject in German schools (whether on basic or advanced level) and belongs to most of the TUM School of Education's subject combinations.

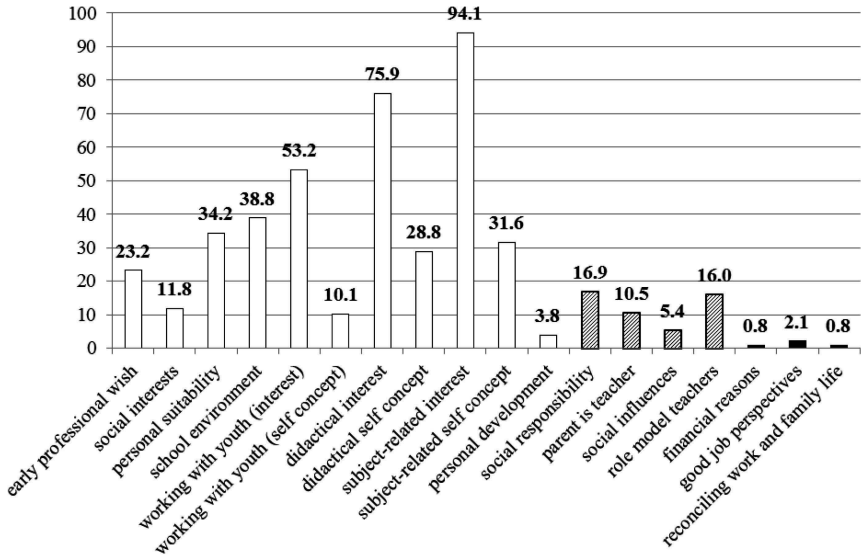

Figure 1: Study motives mentioned in the applicants' letters of motivation.

4.3 Personal prerequisites

Our results show that 41.2 % ($N = 97$) of the pre-service teacher candidates had given private tutoring lessons to other students (cf. *figure 2*). Furthermore, 28.2 % ($N = 66$) had tutoring and other didactical pre-experiences in school or tuition institutes. Internships and special engagement in schools were reported by 25.6 % ($N = 60$) of our applicants. Socio-educational experiences, mainly training children in sports and youth work, applies to 50.0 % ($N = 118$). In sum, 82.4 % ($N = 196$) of our sample reported having had pedagogical experiences, among these 64.8 % ($N = 127$) females and 35.2 % ($N = 69$) males. Chi-square did not reveal a significant difference between both groups' pedagogical experiences ($\chi^2(1) = 2.23$, $p > 0.05$). Thus, 17.6 % ($N = 42$) reported not having had any pedagogical experiences yet. Non-pedagogic experiences (e.g. vocational training) were not considered for further analyses.

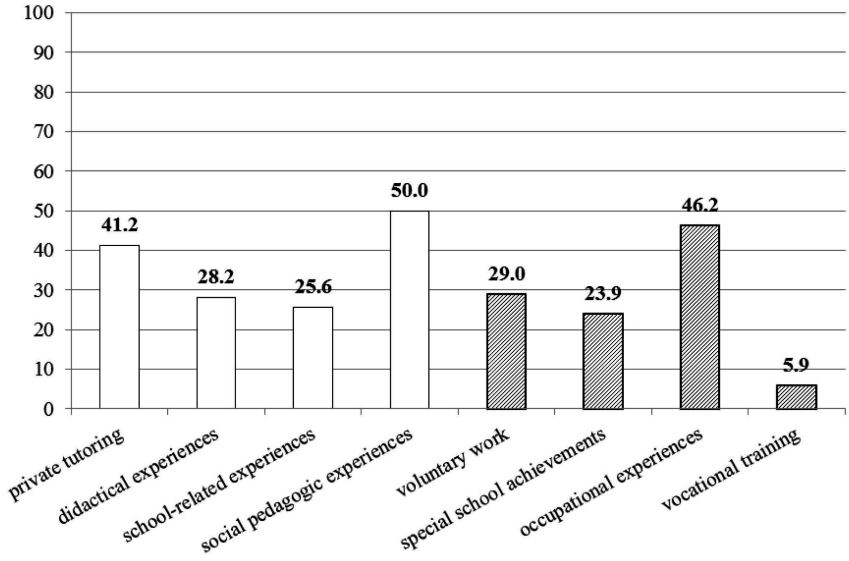

Figure 2: Pedagogical experiences according to the applicants' CVs and certificates.

4.4 Cluster analysis

Two-step cluster analysis was conducted with a reduced selection of variables. In order to further reduce complexity and thus increase the probability for revealing clusters, variables were partly summarized (cf. *table 2*). List-wise case exclusion reduced the sample to $N = 237$ subjects in the cluster analysis. The optimal number of clusters is determined by the lowest BIC value (537.90) and the highest ratio of distance measure (1.77). Five clusters were revealed (cf. *table 3*). Figure 3 gives a graphical overview on the cluster distribution.

Dimension	Indicator		Scale level
Cognitive prerequisites	HSGPA		Continuous (z-transformed)
Motivational prerequisites	Working with youth (interest)	Combined: pedagogical & didactical interest	Binary
	Subject-related interest		Binary
Personal prerequisites (pedagogical experiences)	Private tutoring Didactical experiences School-related experiences Socio-educational experiences	Combined: pedagogical experiences	Binary

Table 2: Overview of the variables used for two-step cluster analysis.

Cluster 1 is the largest group and includes 45.6 % ($N = 108$) of the sample; among these 43.2 % ($N = 64$) females. Subjects of cluster 1 have favourable prerequisites in all dimensions. They have the best HSGPAs in mean ($M = 2.03$, $SD = .56$) and their subjects in upper school and university correspond to each other. Furthermore, all members of cluster 1 show excellent motivational orientations and have experience in pedagogical fields. The variables corresponding to subject choice, pedagogical experiences, pedagogical & didactical interest and subject-related interest are – in descending order – significant in differentiating this cluster from the other clusters.

The smallest cluster with 5.9 % ($N = 14$) of our sample is *cluster 2*. It includes $N = 8$ (57.1 %) females. HSGPAs are $M = 2.16$ ($SD = .46$) in mean and 50.0 % have corresponding subjects. Almost all members of this cluster reported pedagogical or didactical study motives, but nobody reported subject-related interest in the letters of motivation. The majority (78.6 %) had pedagogical experience. Concerning cluster 2, only the variable subject-related interest is significant for group differentiation.

Cluster 3 includes 13.5 % (N = 32) of the sample with 62.5 % (N = 20) females. HSGPAs are M = 2.14 (SD = .60) in mean and 40.6 % have corresponding subjects. Nobody reported pedagogical or didactical study motives; but all of them had subject-related interests. N = 19 (59.4 %) members of this cluster have experiences in pedagogical fields. Variables which were significant for differentiation are pedagogical & didactical interest and pedagogical experiences.

10.5 % (N = 25) were allocated to *cluster 4*; among these 56.0 % females. These cluster members' HSGPAs are M = 2.18 (SD = .53) in mean and 60.0 % have corresponding subjects. All cluster members reported pedagogical and subject-related interests in their letters of motivation. Nobody had pedagogical experience, which is the only significant variable in differentiating cluster 4.

The *fifth cluster* includes 24.5 % (N = 58) of the sample and is strongly dominated by females (72.4 %; N = 42). HSGPAs are M = 2.20 (SD = .55) in mean. Nobody in this cluster has corresponding subjects but all members have pedagogical or didactical study motives, subject-related interests and experiences in pedagogical fields. Differentiating variables are corresponding subjects, pedagogical experiences and pedagogical & didactical interest.

HSGPAs do not significantly contribute to the group differentiations. This is confirmed by analysis of variance (ANOVA), which did not reveal significant differences between the individual clusters' HSGPAs ($F(4)$ = 1.03, p > .05). Further, the applicants' gender does not differ significantly between the clusters ($\chi^2(4)$ = 3.54, p > .05).

		Clusters				
	Total *N* = 237 (100%)	1 *N* = 108 (45.6 %)	2 *N* = 14 (5.9 %)	3 *N* = 32 (13.5 %)	4 *N* = 25 (10.5 %)	5 *N* = 58 (24.5 %)
HSGPA	*M* = 2.11 (*SD* = .55)	*M* = 2.03 (*SD* = .56)	*M* = 2.16 (*SD* = .46)	*M* = 2.14 (*SD* = .60)	*M* = 2.18 (*SD* = .53)	*M* = 2.20 (*SD* = .55)
Corre- sponding subject choice	*N* = 143 (60.3 %)	108 (100 %)	7 (50.0 %)	13 (40.6 %)	15 (60.0 %)	0 (0.0 %)
Pedagogical / didactical interest	*N* = 204 (86.1 %)	108 (100 %)	13 (92.9 %)	0 (0.0 %)	25 (100 %)	58 (100 %)
Subject- related interest	*N* = 223 (94.1 %)	108 (100 %)	0 (0.0 %)	32 (100 %)	25 (100 %)	58 (100 %)
Pedagogical experiences	*N* = 196 (82.7 %)	108 (100 %)	11 (78.6 %)	19 (59.4 %)	0 (0.0 %)	58 (100 %)

Table 3: Five cluster solution (method: two-step cluster analysis). N = 1 missing (list-wise). Inaccuracies emerged due to rounding.

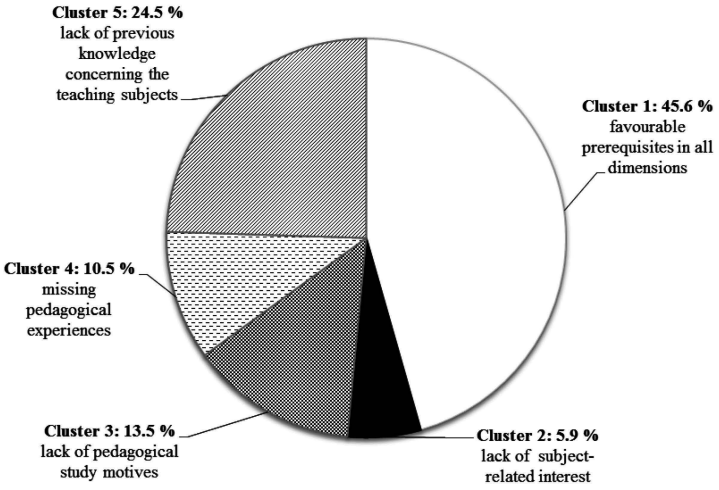

Figure 3: Overview of the cluster distribution with key characteristics.

5. Discussion

In this study, we investigated the cognitive, motivational and personal prerequisites of a complete cohort of pre-service teacher candidates. We analysed certificates of having passed the Abitur, letters of motivation, curricula vitae and certificates to obtain information on our applicants' prerequisites. Our aim was to evaluate the information gained from the application documents and to identify clusters based on the prerequisites of the pre-service teacher candidates.

Descriptive results show that most pre-service teacher candidates of our sample have high cognitive prerequisites which are favourable for academic achievements (cf. Robbins et al., 2004; Trapmann, 2008). Thus, we do not assume a negative selection (Rothland, 2011). Comparative studies revealed good prerequisites for grammar school student teachers, too; often in comparison to students of other types of school or other study subjects (e.g. Giesen & Gold, 1994). More than 60 % of the pre-service teacher candidates chose their teaching subjects already in upper school; therefore we assume a solid subject-related previous knowledge. As mathematics is an obligatory subject in some German states and belongs to most of the subject combinations at the TUM School of Education, we cannot conclude early subject-related interest by implication.

Content analyses of the applicants' letters of motivation revealed that the applicants give a variety of reasons for their study choice. This might be induced by the open format. Our results replicate earlier research which revealed that teacher training aspirants have a mainly intrinsic, pedagogic and subject-oriented study motivation (e.g. Pohlmann & Möller, 2010). These are good preconditions for adequate study durations, low dropout rates, high academic achievements and later job satisfaction (cf. Blömeke, 2009; Credé & Kuncel, 2008). However, we have to assume that the measured study motives are biased due to social desirability.

The pre-service teacher candidates' curricula vitae and certificates provide a wealth of information on the applicants' activities in and outside school. Many applicants showed an impressive engagement in pedagogical fields before study entry, especially in the social educational field and in private tutoring. This shows early interest in pedagogical work, which is typical for teacher aspirants (cf. Nieskens, 2009). However, as only about one third gave evidence of their previous experience, most data is self-reported.

Cluster analyses revealed five distinct groups of pre-service teacher candidates. Almost half of our sample (45.6 %, *cluster 1*) showed excellent prerequisites in all dimensions. A further 24.5 % (*cluster 5*) differ only in marginal worse HSGPAs and non-corresponding subject choices. However, as subject-related study motives were reported, the non-corresponding subject choices do rather reflect a deficit in previous knowledge instead of motivational aspects. In conclusion, 65 % of the candidates show advantageous prerequisites.

In contrast, more than 13 % (*cluster 3*) of our sample did not report didactical or pedagogical study motives in their letters of motivation, which is striking. Surprisingly, almost 60 % of these persons reported having had pedagogical experience. Possibly, members of this group reported their experiences *instead* of their study motives – which would reflect a rather linguistic issue. However, the prerequisites of the remaining 40 % of cluster 3 who had neither pedagogical experience nor showed pedagogical interest, are seen as very unfavourable for the teacher profession. Further investigations are necessary to reveal if this group of persons actually enrolled into the study programme. Although having excellent cognitive and motivational prerequisites, 10.5 % of our applicants (*cluster 4*) did not have any pedagogical experience and so might have unrealistic expectations regarding pedagogical work and their pedagogical skills. Some candidates (8 %, *cluster 2*) did not report interest in the corresponding teaching subjects. Instead, almost all members of this group (92.9 %) showed pedagogical interest. With regard to the demanding study programme at the

TUM and the future task of inspiring children and youth in knowledge content, we consider subject interest as important. Therefore, these persons' prerequisites are seen as rather unfavourable.

In sum, aspirants for the teacher training programme at the TUM School of Education are a very heterogeneous group. It was possible to identify distinct groups on the basis of the gained variables. The cognitive, motivational and personal prerequisites of the majority of candidates were excellent, but there were sub-groups with rather unfavourable subject-related or pedagogical prerequisites. Analysing the application documents of pre-service teacher candidates revealed a promising approach to gathering meaningful information.

Except for HSGPAs, all variables were revealed as significant for group differentiation. This could reflect a methodological issue, as the effects of continuous variables can be underestimated in two-step cluster analyses. Our study results are limited by data losses due to the variables' binary format. Further research is needed to reveal if our sample is representative for other cohorts and teacher training programmes at other universities.

6. Conclusion

As the pre-service teacher candidates' entry requirements revealed very heterogeneous and almost one third of our sample showed unfavourable prerequisites in the motivational or pedagogical area, we consider aptitude testing before study entry as crucial. Letters of motivation and curricula vitae revealed as useful information sources and helpful complements to cognitive criteria. The consideration of information gained from application documents broadens the spectrum of criteria in university admissions procedures which is crucial to teacher education. Assessments of pre-service teachers' cognitive, motivational and personal prerequisites could be used as a basis for conversation in selective interviews, for example, and/or as a starting point of a continuous consulting process aiming at the development of teacher relevant attitudes and competencies.

However, letters of motivation and curricula vitae should be used as supportive information sources rather than single decisive criteria in selective decisions. Further long-term research is needed in order to reveal the predictive validity of the obtained criteria with respect to academic and occupational success. As a final remark, it is important to add that admissions criteria can optimize the input, but the output also depends on many further conditions (Rindermann & Oubaid, 1999).

References

Albisser, S., Kirchhoff, E., & Albisser, E. (2009). Berufsmotivation und Selbstregulation: Kompetenzentwicklung und Belastungserleben von Studierenden, berufseinsteigenden und erfahrenen Lehrpersonen [Vocational Motivation and Self-Regulation: Competency Development and Strain Experience of Teacher Students, Teachers at Career Entry Phase, and Experienced Teachers]. *Unterrichtswissenschaft*, *37*(3), 262-288.

Amelang, M. & Schmidt-Atzert, L. (Eds.) (2006). *Psychologische Diagnostik und Intervention* [Psychological Diagnostics and Intervention]. Heidelberg: Springer.

Blömeke, S. (2009). Ausbildungs- und Berufserfolg im Lehramtsstudium im Vergleich zum Diplom-Studium. Zur prognostischen Validität kognitiver und psycho-motivationaler Auswahlkriterien [Study and Occupational Success in the Teacher Training Programme Compared to the Diploma Programme – The Prognostic Valiity of Cognitive and Psycho-Motivational Admissions Criteria]. *Zeitschrift für Erziehungswissenschaft*, *12*(1), 82-110.

Brosius, F. (Ed.) (2011). *SPSS 19*. Heidelberg: mitp.

Capelli, P. (Ed.) (1991). *Assessing College Education: What Can be Learned from Practices in Industry?* East Lansing, MI: National Center for Research on Teacher Learning.

Credé, M. & Kuncel, N. R. (2008). Study Habits, Skills, and Attitudes: The Third Pillar Supporting Collegiate Academic Performance. *Perspectives on Psychological Science, 3*(6), 425-453.

Emmerich, W., Rock, D. A., & Trapani, C. S. (2006). Personality in Relation to Occupational Outcomes among Established Teachers. *Journal of Research in Personality*, *40*(5), 501-528.

Fellenberg, F. & Hannover, B. (2006). Kaum begonnen, schon zerronnen? Psychologische Ursachenfaktoren für die Neigung von Studienanfängern, das Studium abzubrechen oder das Fach zu wechseln [Easy Come, Easy Go? Psychological Causes of Students Drop Out of University or Changing the Subject at the Beginning of their Study]. *Empirische Pädagogik. Zeitschrift zu Theorie und Praxis erziehungswissenschaftlicher Forschung, 20*(4), 381-399.

Foerster, F. (2006). Persönlichkeitsmerkmale von Studienanfängerinnen des Lehramts an Grundschulen – Ein Vergleich verschiedener Wege des Studienzugangs [Personality Traits of Study Beginners for Primary School Teaching – A Comparison of Different Study Entrance Procedures]. In J. Seifried & J. Abel (Eds.), *Empirische Lehrerbildungsforschung. Stand und Perspektiven* (pp. 45-61). München: Waxmann.

Giesen, H. & Gold, A. (1994). Die Wahl von Lehramtsstudiengängen. Analysen zur

Differenzierung von Studierenden der verschiedenen Lehrämter [The Choice of Teacher Training Programmes. Analyses of Differentiations Between Students of Different Teacher Training Programmes]. In J. Mayr (Ed.), *Lehrer/in werden* (pp. 64-78). Innsbruck: Studien-Verlag.

Gold, A. & Souvignier, E. (2005). Prognose der Studierfähigkeit. Ergebnisse aus Längsschnittanalysen [Prediction of College Outcomes. Results from Longitudinal Studies]. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie, 37*(4), 214-222.

Gottfredson, L. S. (2003). The Challenge and Promise of Cognitive Career Assessment. *Journal of Career Assessment, 11*(2), 115-135.

Heine, C., Briedis, K., Didi, H.-J., Haase, K., & Trost, G. (Eds.) (2006). *Auswahl- und Eignungsfeststellungsverfahren beim Hochschulzugang in Deutschland und ausgewählten Ländern: Eine Bestandsaufnahme [Admissions and Aptitude Testing Procedures for University Access in Germany and Selected Countries: A Baseline Study]*. HIS Forum Hochschule: Hannover.

Keller-Schneider, M. (2009). Was beansprucht wen? Entwicklungsaufgaben von Lehrpersonen im Berufseinstieg und deren Zusammenhang mit Persönlichkeitsmerkmalen [Challenges in Teachers' Career Entry Phase and their Relation to Personality Factors]. *Unterrichtswissenschaft, 37*(2), 145-163.

Kultusministerkonferenz, KMK (2004). *Sekretariat der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik Deutschland: Standards für die Lehrerbildung: Bildungswissenschaften* [Standing Conference of the Ministers for Education and Cultural Affairs of the Länder of the Federal Republic of Germany: Standards for Teacher Education: Educational Sciences]. Retrieved November 13, 2012, from http://www.kmk.org/fileadmin/veroeffentlichungen_beschluesse/2004/2004_12_16-Standards-Lehrerbildung.pdf

Kokkinos, C. M. (2007). Job Stressors, Personality and Burnout in Primary School Teachers. *British Journal of Educational Psychology, 77*(1), 229-243.

Kunter, M., Baumert, J., Blum, W., Klusmann, U., Krauss, S., & Neubrand, M. (Eds.) (2011). *Professionelle Kompetenz von Lehrkräften: Ergebnisse des Forschungsprogramms COACTIV [Professional Competence of Teachers: Results of the Research Program COACTIV]*. Münster: Waxmann.

Künsting, J. & Lipowsky, F. (2011). Studienwahlmotivation und Persönlichkeitseigenschaften als Prädiktoren für Zufriedenheit und Strategienutzung im Lehramtsstudium [Study Choice Motivation and Personality Traits as Predictors for Study Success and Use of Strategies in Teacher Education Programmes]. *Zeitschrift für Pädagogische Psychologie, 25*(2), 105-114.

Linnenbrink, E. A. & Pintrich, P. R. (2002). Motivation as an Enabler for Academic Success. *School Psychology Review, 31*(3), 313-327.

Lipowsky, F. (Ed.) (2003). *Wege von der Hochschule in den Beruf – Eine empirische*

Studie zum beruflichen Erfolg von Lehramtsabsolventen in der Berufseinstiegsphase [Paths from University to Occupation – an Empirical Study on the Occupational Success of Teacher Training Graduates in their Career Entry]. Bad Heilbrunn (Obb.): Klinkhardt.

Mayr, J. (1998). Die „Lehrer-Interessen-Skalen" (LIS). Ein Instrument für Forschung und Laufbahnberatung [The Teacher-Interest-Scales. An Instrument for Research and Career Path Counseling]. In J. Abel & Ch. Tarnai (Eds.), *Pädagogisch-psychologische Interessenforschung in Studium und Beruf* (pp. 111-125). Münster: Waxmann.

Mayr, J. (2007). Wie Lehrer/innen lernen: Befunde zur Beziehung von Lernvoraussetzungen, Lernprozessen und Kompetenz [How Teachers Learn. Findings on the Relation of Learning Prerequisites, Learning Processes and Competence]. In M. Lüders (Ed.), *Forschung zur Lehrerbildung. Kompetenzentwicklung und Programmevaluation* (pp. 151-168). Münster: Waxmann.

Mayr, J. (2010). Selektieren und/oder qualifizieren? Empirische Befunde zur Frage, wie man gute Lehrpersonen bekommt [Selection and/or Qualification? Empirical Results to the Question of How to Get Good Teachers]. In J. Abel & G. Faust (Eds.), *Wirkt Lehrerbildung?* (pp. 73-89). Münster: Waxmann.

Mayr, J. (2011). Der Persönlichkeitsansatz in der Lehrerforschung. Konzepte, Befunde und Folgerungen [The Personality Approach in Teacher Research. Concepts, Results and Consequences]. In E. Terhart, H. Bennewitz, & M. Rothland (Eds.), *Handbuch der Forschung zum Lehrerberuf* (pp. 125-148). Münster: Waxmann.

Mayr, J. & Neuweg, G. H. (2006). Der Persönlichkeitsansatz in der Lehrer/innen /forschung. Grundsätzliche Überlegungen, exemplarische Befunde und Implikationen für die Lehrer/innen/bildung [The Personality Approach in Teacher Research. Fundamental Considerations, Exemplary Results and Implications for Teacher Education]. In M. Heinrich & U. Greiner (Eds.), *Schauen was rauskommt. Kompetenzförderung, Evaluation und Systemsteuerung im Bildungswesen* (pp. 183-206). Wien: Lit.

McCrae, R. R. & Costa, P. T. (1987). Validation of the Five-Factor Model of Personality across Instruments and Observers. *Journal of Personality and Social Psychology, 52*(1), 81-90.

Müller-Benedict, V. (2010). Grenzen von leistungsbasierten Auswahlverfahren [Limits of Performance Based Admission Procedures]. *Zeitschrift für Erziehungswissenschaften, 13*(3), 451-472.

Nieskens, B. (Ed.) (2009). *Wer interessiert sich für den Lehrerberuf – und wer nicht? Berufswahl im Spannungsfeld von subjektiver und objektiver Passung* [Who Is Interested in the Teaching Profession and Who Not? Occupational Choices and the Tension of Subjective and Objective Fit]. Göttingen: Cuvillier Verlag.

Pohlmann, B. & Möller, J. (2010). Fragebogen zur Erfassung der Motivation für die Wahl des Lehramtsstudiums (FEMOLA) [Motivation for Choosing Teacher Education Questionnaire]. *Zeitschrift für Pädagogische Psychologie, 24*(1), 73-84.

Retelsdorf, J. & Möller, J. (2012). Grundschule oder Gymnasium? Zur Motivation ein Lehramt zu studieren [Primary or Secondary School? On the Motivation for Choosing Teacher Education]. *Zeitschrift für Pädagogische Psychologie, 26*(1), 5-17.

Rindermann, H. & Oubaid, V. (1999). Auswahl von Studienanfängern durch Universitäten – Kriterien, Verfahren und Prognostizierbarkeit des Studienerfolgs [Selection of Students by Universities – Criteria, Methods and Predictability of Study Success]. *Zeitschrift für Differentielle und Diagnostische Psychologie, 20*(3), 172-191.

Roberts, B. W. & DelVecchio, W. F. (2000). The Rank-Order Consistency of Personality Traits from Childhood to Old Age: A quantitative Review of Longitudinal Studies. *Psychological Bulletin, 126*(1), 3-25.

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do Psychological and Study Skill Factors Predict College Outcomes? A Meta-Analysis. *Psychological Bulletin, 130*(2), 261-288.

Rothland, M. (2011). Wer entscheidet sich für den Lehrerberuf? [Who decides for the teacher profession?]. In E. Terhart, H. Bennewitz & M. Rothland (Eds.), *Handbuch der Forschung zum Lehrerberuf* (pp. 243-267). Münster: Waxmann Verlag.

Schaarschmidt, U. (2004). Fit für den Lehrerberuf? Psychische Gesundheit von Lehramtsstudierenden und Referendaren [Fit for the Teaching Profession? Mental Health of Teacher Training Students and Pre-Service Teachers]. In U. Beckmann, H. Brandt, & H. Wagner (Eds.), *Ein neues Bild vom Lehrerberuf? Pädagogische Professionalität nach Pisa* (pp. 100-115). Weinheim: Beltz.

Schaarschmidt, U. (2007). Die Potsdamer Lehrerstudie. Eine vorläufige Bilanz [The Teacher Study of Potsdam. A Provisional Balance. Deutscher Philologenverband. *Profil. Das Magazin für Gymnasium und Gesellschaft, 3*, 4-10.

Schendera, C. F. G. (Ed.) (2010). *Clusteranalyse mit SPSS: Mit Faktorenanalyse* [Clusteranalysis with SPSS: With Factor analysis]. München: Oldenbourg.

Schmitt, N. (2012). Development of Rationale and Measures of Noncognitive College Student Potential. *Educational Psychologist, 47*(1), 18-29.

Schmitt, N., Keeney, J., Oswald, F. L., Pleskac, T .J., Billington, A. Q., Sinha, R., & Zorzie, M. (2009). Prediction of 4-Year College Student Performance Using Cognitive and Noncognitive Predictors and the Impact on Demographic Status of Admitted Students. *Journal of Applied Psychology, 94*(6), 1479-1497.

Smith, H. A. & Pratt, D. (1996). The Use of Biodata in Admissions to Teacher Education. *Journal of Teacher Education, 47*(1), 43-52.

Stemler, S. E. (2012). What Should University Admissions Tests Predict? *Educational Psychologist, 47*(1), 5-17.

Sternberg, R. J. & Grigorenko, E. L. (Eds.) (2002). *The General Factor of Intelligence: How General is it?* London: Lawrence Erlbaum Associates.

Spiel, C., Litzenberger, M., & Haiden, D. (Eds.) (2006). *Bildungswissenschaftliche und psychologische Aspekte von Auswahlverfahren* [Educational Sciences and Psychological Aspects of Admissions Procedures]. Unpublished PhD thesis, Universität Wien.

Tarazona, M. (2006). Berechtigte Hoffnung auf bessere Studierende durch hochschuleigene Studierendenauswahl? Eine Analyse der Erfahrungen mit Auswahlverfahren in der Hochschulzulassung [Legitimate Hope for Better Students Through Student Selection by Universities? An Analysis of Experiences with Selection Procedures in the Academic Context]. *IHF Beiträge zur Hochschulforschung, 28*(2), 68-89.

Trapmann, S. (Ed.) (2008). *Mehrdimensionale Studienerfolgsprognose: Die Bedeutung kognitiver, temperamentsbedingter und motivationaler Prädiktoren für verschiedene Kriterien des Studienerfolgs* [Multidimensional Prognosis of Study Success: The Significance of Personal and Motivational Predictors for Study Success Criteria]. Berlin: Logos.

Urban, W. (1992). Untersuchungen zur Prognostizierbarkeit der Berufszufriedenheit und der Berufsbelastung bei österreichischen Hauptschullehrern [Research on the Predictability of Job Satisfaction and Occupational Stress of Austrian Teachers]. *Zeitschrift für Empirische Pädagogik, 6*, 131-148.

Urban, W., Reisinger, C. M., & Samac, K. (2010). Neue Untersuchungen zur heuristischen Kompetenz auf der Basis der Theorie der personalen Ressourcen und des Umgangs mit Komplexität und Unbestimmtheit [New Research on Heuristic Competence Based on the Theory of Personal Ressources and Coping of Complexity and Indefiniteness]. In I. Benischek (Ed.), *Empirische Forschung zu schulischen Handlungsfeldern. Ergebnisse der ARGE Bildungsforschung an Pädagogischen Hochschulen in Österreich* (pp. 135-159). Münster: LIT.

Wirtz, M. & Caspar, F. (Eds.) (2002). Beurteilerübereinstimmung und Beurteilerreliabilität [Interrater agreement and interrater reliability]. Göttingen: Hogrefe.

Wright, S. P., Horn, S. P., & Sanders, W. L. (1997). Teacher and Classroom Context Effects on Student Achievement: Implications for Teacher Evaluation. *Journal of Personnel Evaluation in Education, 11*(1), 57-67.