Competence indicators in academic education and early labour market success of graduates in health sciences

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Contents

Abstract

In this study, the effects of several educational and non-educational indicators of (aspects of) competence on short-term labour market outcomes for university graduates are estimated. The research question we address is: To what extent do indications of specific and generic competence during the educational program predict labour market outcomes? Labour market outcomes in this study pertain to employment chances and quality of the job (having a job, academic level, matching occupational domain and wages). We use data on specific and generic aspects of competence, all of which were assessed during the academic study course, i.e. test scores on the attainment of domain specific knowledge, scores on group functioning, and the Masters' thesis result. In addition, some other indicators of human capital acquired outside education are used, i.e. relevant work experience and managerial experience. The results indicate a rather differentiated pattern for the value of specific and generic competence acquired during education for the labour market.

Key words: education, student performance, competence, human capital, labour market outcomes. JEL-classification: J24

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1 Introduction

Research context

Today's labour conditions have become highly changeable. People do rarely work in one firm, or for one boss during their entire working life anymore. Especially the higher educated are expected to create their own career paths, in which personal development and growth in personal responsibility seem to play an important role (Hall & Moss, 1998).
This personal growth and development is the result of a delicate mix of what people have available from innate abilities and their experiences by growing up and being educated. Labour market relevant knowledge and skills, as well as a set of personal competences are seen as crucial to successful functioning and development afterwards (see e.g. Anderson & Marshall, 1994; Nijhof, 1998).

The role of academic education for the labour market

Education plays an important role in what people learn before entering the labour market. In our so-called knowledge society or knowledge economy, especially higher and academic education is faced with the large responsibility to prepare students for the best functioning on the labour market in higher level and management positions.
Some authors emphasize the crucial role of the so-called 'specific' competence development during education: the profession- or field-specific knowledge and skills that are relevant for the type of jobs for which the educational program prepares (see e.g. Boshuizen, 2004). Other authors argue it is most important to pay attention to the so-called 'generic' competences, skills like the ability to learn (to learn), and more academically 'conceptual competence', as well as communication and teamwork skills (see e.g. Vermetten, 1999; Stasz, 1998; Mulders, 1995).
This apparent contradiction may be explained by two factors. On the one hand, educational programs may have different goals regarding the preparation for the labour market. On the other hand, different priorities in education relate to different definitions and classifications of competence and different operationalizations.

Different goals of educational programs regarding the labour market

Some educational programs prepare for a specific profession, or a limited set of jobs and occupations. Medicine is an example. Other programs prepare for a broad range of occupations, such as economics (De Wolf, 2000; Borghans & de Grip, 1999). And again other programs take positions in between, resulting in differences in the priority for different types of competence. Moreover, priorities may vary when considering competences that are most important for entering the labour market versus those that are important for functioning later in the career. It seems inevitable that choices have to be made about what priorities prevail and why. These choices are more easily made when supported by empirical data about the effects of differential educational achievements of students on their labour market outcomes. And it is exactly here where the data are missing. A considerable lack of empirical evidence seems to exist, especially when it comes to what students *actually* have learned in

education, and the effects of competence development in education on labour market outcomes (see e.g. Sørensen, 1994).

The concept of competence and educational measurements

Different approaches to the concept of competence constitute a second reason for divergent views on what type of competence is most important for the labour market. It is in fact a rather complicated concept for the educational context (see e.g. Westera, 2001). It is common understanding that the concept comprises knowledge, skills and attitudes of people, plus something extra that makes it more than just the sum of the separate parts. This extra refers to the more holistic character of the concept of competence. It emphasizes that human functioning in work should not only be defined in separate components of knowledge and skills, but should also be considered as a whole. However, exactly the 'extra' can not unequivocally, and thus satisfactory, be defined to make the concept more useful in educational research than the traditional separate knowledge, skills and attitudes components that refer to (differences in) human functioning. So, many different definitions and operationalizations of competence float around in the literature (for overviews, see e.g., Toolsema, 2003; Westera, 2001), but they offer no systematic base for future research yet. Meanwhile, both traditional and more innovative study achievement measurements on knowledge and skills have been used for decades in academic programs. These measurements have not yet been studied systematically for their labour market value.

Purpose of the study

This study is meant to offer more empirical insight into which educational indicators of competence are relevant in explaining labour market outcomes of academic graduates. More precisely, we consider several data on study achievement and other (non-educational) experiences of students during their academic study in terms of how these refer to a more specific[1] or generic type of competence, and how they affect short term labour market outcomes. While taking into account narrow versus broad educational programs and other factors, we investigate to what extent different educational indicators of competence predict labour market outcomes.

2 Theoretical background

Relevant labour market research and instruments

In labour market research, the measurement of what people actually learn in education has never been a major point of focus. Labour market research is interested in the role of education for the labour market, though. Different academic educational programs are considered to have different functions or roles for the labour market. So-called narrow

1. Specific competence refers to domain- or field-specific competence, which is different from the so-called *firm-specific* human capital as used in more traditional economic literature, by for example Becker (1964; 1983).

educational programs (such as medicine) prepare for a small range of jobs, or a smaller job domain, whereas broad programs (such as economics) prepare for a broader range of functions, or a broader job domain (Borghans & de Grip, 1999).

Seen from the perspective of a single educational program, the labour market can be divided into different parts, in which the educational program either has a tight fit (between the competence demand of this particular labour market domain and the competence supply of the educational program), or a much looser fit, or, in some cases, no fit at all (a physician is unlikely to be hired as an advocate). So, not only the width of the job domain is important to take into account when analysing the importance of certain types of competence for the labour market, but also the fit between competence supply and competence demand. So-called assignment models within the job matching theory (for an overview see Sattinger, 1993) assume that depending on the characteristics of the job, different characteristics of the worker are rewarded (such as a particular educational background, or a certain type of competence). In this sense, the quality of the match, thus the 'fit' between competence supply of the individual and competence demand of the job, determines the productivity in a job (see also Van Eijs & Heijke, 2000). Recent research reveals that field-specific competences enhance the chances to obtain a matching job (which in turn raises the wages), whereas generic or academic competences enhance the chances to obtain jobs outside the own occupational domain (Heijke, Meng & Ris, 2003) and help to acquire other competences, such as the required specific competences for the job (Heijke, Meng & Ris, 2003) and so-called management competences (Heijke, Meng & Ramaekers, 2003) that are rewarded in the labour market.

This 'competence supply' as developed in education has traditionally been measured only indirectly in labour market research by using 'proxy's'. Examples of these proxy's are: the number of years spent in education, the level of education, and the type of education (De Koning, 1998), or study field (e.g. Finnie & Frenette, 2003). These proxy's for education and the human capital acquired in education have been used in research next to the measurements for non-educational human capital, such as managerial experience and work experiences (see e.g. Brunello & Comi, 2004; Heijke, Koeslag & van der Velden, 1998). The most direct measurements of what (academic) education adds to the individuals' competence base are 'study results' during education. However, these study results often refer to some grade point average (indicating the mastery of a specified set of skills or knowledge on a specific and restricted moment in time), and do not shed much light on the actually developed type of competence, skills, or knowledge in education over the years. Nor do they include differences between specific and generic measurements or a longitudinal perspective. Recently, considerable effort has been applied to study the labour market value of skills or work related competences (learnt in education) in a retrospective manner, for example by self-reports of students (see e.g. Heijke, Meng & Ramaekers, 2003; Allen & van der Velden, 2001; Heijke et al., 1998). It is therefore useful to expand this type of research with contemporary educational measurements of what students have learnt in education.

Relevant educational research and possible instruments

The learning process in academic education is studied from different theoretical perspectives. In the expertise development view (see e.g. Boshuizen, 2004) the emphasis is on the individual and mainly cognitive development that underlies the development of professional expertise. The establishment of a solid knowledge base is considered crucial, and especially to be acquired in the academic educational phase. In this respect, the development of a rather *specific* type of competence in academic education, i.e. domain- or field-specific knowledge prevails.

To measure acquired domain-specific knowledge, traditionally multiple choice knowledge tests are used (Straetmans, 1998). However, these traditional knowledge tests do not go beyond the measurement of the mastery of a specified set of knowledge items, and seem to stimulate the use of short-term memory, instead of leading to deep rooted knowledge (Verhoeven, 2003). There are other types of knowledge tests, such as the so-called Progress test, that follow the development in the acquisition of domain-specific knowledge more accurately (i.e. longitudinally). This type of test seems to stimulate more deep rooted knowledge (Verhoeven, 2003).

In self-regulated learning theories, the process of (individual) learning in academic education is the central issue (see e.g. Boekaerts, Pintrich & Zeidner, 2000), and therefore refers to a more generic component of competence. In this sense, generic competence refers to meta-cognitive capabilities and processing strategies of students. The use and practice of these capabilities and strategies help people to learn and gain academic and conceptual competence (see e.g. Ross, Salisbury-Glennon, Guarino, Reed & Marshall, 2003; Van den Bosch & Gerritsen, 1997). To measure these strategies, different types of study or learning style instruments are used, such as the Study Process Questionnaire (SPQ) of Biggs (1978), the Inventory of Learning Styles (ILS) of Vermunt (1992, 1996, 1998) and the Revised Approaches to Studying Inventory (RASI) of Entwistle and Tait (1994). Most of the instruments are used for research purposes, not for large-scale and standardized monitoring of the learning process of students during their education.

Generic competence also refers to other general skills, such as teamwork skills and communicative skills (see e.g. Stasz, 1998). These types or aspects of generic competence are not often measured separately in educational programs. Learning these skills is often integrated in the instructional design (working in teams to solve domain related problems, giving presentations) or in the educational philosophy as a whole, such as in Problem Based Learning (PBL; see e.g. Savery & Duffy, 1995; Schmidt & Moust, 1998) or in institutional approaches (see e.g. Atlay & Harris, 2000). In some PBL curricula, group functioning scores are gathered during the educational process. Therefore, measurements of teamwork and communicative skills seem relevant.

Competence oriented education emphasizes the *integrated* nature of what students must learn to be prepared for working life. In fact, current competence based education integrates features of several other innovations in education (such as self-regulated learning and

elements of PBL or project learning), instead of having a unique form or character itself. It merely reflects the overall vision on the objectives of education for these innovations. Advocates argue that the traditional division in separate skills, knowledge and attitudes that students must learn in education is rather artificial. And *competence* is what in fact has been underlying the separate elements that can be distinguished and measured in the first place (see e.g. Paulson, 2001). Although more difficult, the measurement of 'competences' instead of separate elements has the advantage that it has more day-to-day reality value. Competence oriented and competence based education have proven their value, as can be illustrated by examples worldwide (see e.g. Schlusmans, Slotman, Nagtegaal & Kinkhorst, 1999; Boyatzis, Cowen, Kolb & Associates, 1995; Stillman, Wang, Quang, Zhang, Yang & Sawyer, 1997). How the integrated 'competences' should be assessed in (academic) education is a matter of ongoing discussion and development (see e.g. McMullan, Endacott, Gray, Jasper, Miller, Scholes & Webb, 2003; Elshout-Mohr, Oostdam & Overmaat, 2001; 2002; Bers, 2001).

An example of an *integrated* measurement of competence that is already widely used in (academic) education is the classical Masters' thesis. In fact, several types of knowledge and skills need to be combined and used by the student to succeed in the production process of this thesis (see also Petr, 1998, on the interaction between writing and learning). In the context of measuring competence instead of separate knowledge and skills, this instrument therefore has some desired features that should be explored for their predictive value.

Research model and relations to be explored

Based on the theoretical considerations above, we explore the predictive value of several educational assessments that have been used in daily practice of curricula in the Health Sciences faculty of Maastricht University. This implies a focus of the research on individual differences in competence, acquired within a given educational context. In fact, thereby the effect of education as such is already acknowledged, as well as the effect of the choice for a certain study field by students, and the effect of the curriculum on the type and amount of competence acquired. It must be noted that the variability in competence between students of different studies or different types of education is much larger than the variability between students within the same study field and curriculum. The research sample has some advantages. In the first place, the seven curricula considered within this faculty have different scopes on the labour market; both narrow and broader curricula can be distinguished and studied for their effects on labour market outcomes. It must be noted, that overall Health Sciences has to a certain extent a restricted matching job domain in the labour market (i.e. health care), which is broader than that of medicine, but narrower than that of a study like economics.

A second advantage of the research sample is that in the curricula, test scores for the total amount of acquired domain specific knowledge, scores for group functioning and the Masters' thesis results can be used as study achievement assessments. These assessments provide innovative or integrated measurements within the educational context.

In explorative analyses, we examine to what extent each of the competence indicators predict labour market outcomes in terms of obtaining a job, obtaining an academic job, a matching job and the wage. As the competence indicators are all considered to measure something relevant for labour market functioning, the relations are considered to be positive.
Based on the results of labour market studies, it is also explicitly considered whether more *specific* competence indicators are predictive for labour market outcomes in terms of obtaining a matching job for study field, in line with the findings of Heijke, Meng and Ramaekers (2003) and Heijke, Meng and Ris (2003). Since wages are also expected to be higher for matching jobs (Heijke, Meng & Ramaekers, 2003), interactions of competence indicators and this type of jobs will be considered as well.

With respect to more *generic* competence indicators we explore their general functional role for the labour market (see e.g. Stasz, 1998). In this respect, we found concepts such as learning style and personality to be more predictive for labour market outcomes for economists than specific educational achievement assessments or working and managerial experience (Semeijn, Boone, Van der Velden & Van Witteloostuijn, 2005; Semeijn & Van der Velden, 2002).

Positive effects of (relevant) working and managerial experience on labour market outcomes are expected though, as sustained by previous and other labour market studies (see e.g. Brunello & Comi, 2004).

Finally, we like to explore explicitly to what extent the Master's thesis will have predictive value for labour market outcomes. Since the Masters' thesis measures the mastery of an integrated set of both specific and generic types of knowledge and skills (also generic academic competence), we expect higher scores to be valuable for obtaining matching and academic jobs (in turn leading to higher wages), in both narrow and broad programs.
In the following section, our instruments, the data and models of analysis will be outlined.

3 Data and methodology

Subjects

The research population consists of graduates in Health Sciences (Masters) from Maastricht University who started their studies in the years 1991-1993.

Competence indicators:

Indicators of competence that are considered to measure more specific aspects are:
- Final Progress Test score in the fourth year of study
- Relevant working experience during study (dummy; yes/no)

Indicators of competence that are considered to measure more generic aspects are:

- Total amount of points for group functioning (GF-score), gathered during the study (dummy's for low, high and missing scores)
- Managerial experience during study[2] (dummy; yes/no)

And a more integrated indicator of competence is:

- Masters' thesis result at the end of education

The competence indicators have the following features:

- *Progress Test scores* refer to an educational assessment of the growth of knowledge in the entire educational (health sciences) study domain (see Van Berkel, Sprooten & De Graaff, 1993; Van Berkel, Nuy & Geerligs,1995). It therefore mainly refers to a specific component of competence (educational domain knowledge). The test consists of several hundreds of (knowledge) items that are administered to all students of all study years of the program. The qualification of a students' knowledge is defined in terms of its actual distance to the level that has to be reached at the end of the educational program. As a consequence, the final Progress test score of the fourth (nominal) study year reflects the acquired level of knowledge of a student at the end of the educational program. The total score on a Progress Test is expressed as a percentage score of the correct answers minus the false answers. The assessment qualification for the student is relative to the scores of all students in the same study year.

- G*roup Functioning scores* (GF-scores) refer to the number of points that has been gathered by students because of desired specific features in their behaviour in (educational) groups. This behaviour refers to capacities in communication and teamwork, such as participation in discussion, leadership skills, stimulating others, and presentation of information and knowledge. The points (one per student) are assigned by the teacher at the end of each course period (i.e. 6 weeks), and are available for *not more* students than half of the educational group. This is to only reward the behaviour that has especially been positive to the group functioning. The total amount of GF-scores (at a maximum of 1 per course period per student) refers to the amount of points as gathered and administered by the end of the study program. Reliability and validity of the GF-points assessment method have been studied and reveal satisfactory results (Nuy, Van Berkel & Van Til, 1994). Since the competence that is assessed by this instrument is considered to have value for almost every contemporary job that can be obtained after graduation (i.e. for teamwork, collaborative learning, and communication), we assume that this instrument measures generic competences. The dummy's are based on whether the scores are below or above the mean total score among the cases in the analyses (*low* and *high* scores) and separately, one is defined for the *missing values*. Students who started their studies in 1991 automatically have missing

2. Although we realize that gaining managerial experience can be a motivated choice of students in the first place, this choice is not dividable from having gained the experience as such, in the data. We however argue this does not interfere with the purpose of our study to explore the value of different indicators of more specific and more generic types of competence.

values, because the GF-scores have only been gathered from 1992 on. Students who started their studies in 1992 and 1993 have missing values whenever doubt arose about the correctness of the total amount of GF-scores as registered. When no doubt was present, i.e. the registration was complete, students without GF-points obtained the total value of 0 (zero) points in the data file.

- *The Masters' thesis result* refers to a qualification on a four-point scale (1 = poor, 2 = insufficient, 3 = sufficient, 4 = good), based on the averaged judgement of different teachers (most often two professors) who have guided the production (process) of the final thesis. Unless the final result is 3 or 4, graduation is not possible. This considerably restricts the actual range in final thesis results in our data. Thesis writing requires both generic (academic skills, communication skills, independency) and specific (field knowledge, statistical skills) types of competence and therefore indicates a rather comprehensive type of performance at the end of academic education.

- *Managerial experience and relevant working experience* are two dummy variables (yes=1, no=0), referring to traditional non-educational human capital indicators. They are often included in labour market research and have proven their relevance for individual labour market outcomes (see e.g. Brunello & Comi, 2004; Heijke, Meng & Ris, 2003). *Managerial experience* as such may be considered a rather generic type of competence, whereas *relevant working experience* refers to more (domain/job) specific competence. The variables are available from two direct questions asked in a labour market survey. From this labour market survey, we also use the measurements of the labour market outcomes and some control variables. Further information about this survey and the variables measured, is therefore presented in the next sub-section.

Instrument for the measurement of labour market outcomes

Labour market outcomes are measured by a labour market survey enclosing our subjects who started their studies in the years 1991-1993. This labour market survey is conducted every year by the Research Centre for Education and the Labour Market (ROA). It gathers labour market information from graduates a year and a half after graduation. The graduation cohorts of 1995-1999 (years of entry in labour market) are included to obtain our research sample of about n=250 graduates for whom data concerning the educational variables, as well as labour market outcomes are available.

More specifically, the following labour market indicators are used from the survey, pertaining to the chances for and the quality of the job, relevant for graduates in the transition phase from education to work (Müller & Gangl, 2003; Van der Velden & Wieling, 1994):

- Having a job (dummy)
- Having a matching job for study field (dummy for having a job for which the own or a comparable educational program is requested by the employer according to the graduate)

- Having an academic job (dummy for having a job for which an academic degree is requested by the employer, according to the graduate)
- Gross hourly wage (log)

Control Variables

Several control variables are included in the study, to avoid bias that may be ascribed to personal characteristics, pre-university education, the occupational scope of the educational program on the labour market, or the labour market situation itself (fluctuations in supply and demand). These are:
- Age
- Gender (dummy for male)
- Pre-university educational level (dummy for highest *general* secondary education)
- Year of entry in the labour market (dummy's)
- Narrowness of the occupational scope of the study specialization[3] (dummy with reference category broad specializations)
- Type of educational program: short or part-time program versus regular doctoral program (dummy for irregular program)

And for the wage estimations:
- Whether the job matches the own occupational domain (dummy)
- Academic level job (dummy)

Method of Analysis

First, we consider the statistical descriptives of our variables, and discuss possible *selectivity* and *multicollinearity* in our data. Second, we explore the relations of our research model with binary logistic and ordinary linear regression (OLS) estimations.
We use a stepwise method: in the first model we estimate the effects of the control variables (model 1). In the second model, we add the effect of the competence indicators (model 2). In the third model all variables are included, as well as interaction effects between competence indicators from the educational context and narrowness of the study field (model 3). In the wage estimations, the dummies for matching and academic jobs are included in model 3 and a fourth model includes the interactions between competence indications and narrowness of study fields on the one hand, and between matching jobs and competence indicators on the other hand.

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3. Study specialisations can be considered as having a narrow or broad occupational scope. For our sample the following study specializations are considered having a narrow scope: biological health sciences, (human) movement sciences and mental health sciences. The following study specializations are considered to have a broad scope: management of health care, nursing sciences, health promotion and education, and theory of health sciences. In appendix 1 the occupational scope of the specialisations is illustrated by the findings of a study of the Health Sciences faculty (1996) into the type of jobs all graduates of the faculty (graduated until august 1995) had obtained.

Table 1
Descriptives and Correlations of the variables

	in analyses:			Correlation Coefficients										
Variables	Mean	SD	N	1	2	3	4	5	6	7	8	9	10	11	12
Indicators of Labour Market Entry Success															
1) Being employed a year and a half after graduation	0.900	0.301	250	-											
2) Having an academic job		0.539	0.500	232	-	-									
3) Having a matching job for study field	0.771	0.421	231	-	-	-									
4) Gross hourly wages (log)		2.361	0.298	210	-	-	-	-							
Specific Competence Indicators															
5) Final Progress Test score in fourth year	14.158	5.791	254	0.084	-0.086	0.203***	0.032	-							
6) Relevant work experience during education	0.476	0.500	254	0.029	-0.033	0.040	0.212***	0.239***	-						
Integrated Competence Indicator															
7) Masters' thesis result		3.493	0.328	254	0.032	0.279***	0.143**	-0.059	0.086	-0.017	-				
Generic Competence Indicators															
8) Managerial experience during education (dummy)	0.453	0.499	254	0.013	0.187***	-0.092	0.034	-0.137**	0.051	0.005	-				
9) Group functioning scores missing (dummy)	0.366	0.483	254	-0.077	-0.039	-0.047	-0.084	0.186***	-0.054	-0.106*	-0.035	-			
10) High Group Functioning scores (dummy)	0.276	0.448	254	0.054	0.288***	-0.025	0.018	-0.232***	-0.077	0.349***	0.076	-0.469***	-		
11) Low Group Functioning scores (dummy)	0.358	0.480	254	0.028	-0.230***	0.070	0.067	0.029	0.126**	-0.219***	-0.036	-0.568***	-0.461***	-	
12) Group Functioning scores		6.199	4.109	161	0.008	0.367***	-0.060	-0.003	-0.186**	-0.045	0.396***	0.116	-	-	-
Control variables															
13) Male	0.118	0.323	254	0.041	-0.016	0.051	0.117*	0.005	-0.007	0.012	0.035	0.102	-0.089	-0.019	-0.026
14) Age	26.409	3.551	254	0.003	-0.196***	-0.015	0.358***	0.154**	0.292***	0.032	-0.134**	0.170***	-0.230***	0.043	-0.325***
15) Pre-university education (dummy for highest general)	0.630	0.484	254	0.072	0.077	-0.027	0.143**	-0.174***	0.127**	0.001	0.058	**-0.501*** **	0.345***	0.182***	0.241***
16) Short or part-time program (dummy)	0.335	0.473	254	0.099	-0.293***	0.159**	0.138**	**0.477*** **	0.309***	-0.081	-0.293***	-0.019	-0.344***	0.340***	**-0.486*** **
17) Broadness of study field (dummy for narrow)	0.386	0.488	254	-0.124*	0.137**	0.075	-0.366***	-0.204***	-0.157**	0.058	-0.087	-0.015	0.163***	-0.137**	0.200**
18) Year of labor market entry 1995	0.110	0.314	254	-0.051	-0.140**	0.085	-0.107	0.125**	-0.109*	-0.050	-0.143**	0.124**	-0.189***	0.052	-0.231***
19) Year of entry 1996	0.398	0.491	254	0.030	-0.047	0.117*	-0.167**	0.386***	0.079	-0.090	-0.076	0.351***	-0.357***	-0.020	-0.297***
20) Year of entry 1997	0.228	0.421	254	-0.069	-0.053	-0.119*	0.175**	-0.223***	0.045	0.029	0.089	-0.160***	0.252***	-0.074	0.281***
21) Year of entry 1998	0.228	0.421	254	0.045	0.207***	0.017	0.057	-0.265***	-0.068	0.106*	0.070	-0.297***	0.252***	0.063	0.093
22) Year of entry 1999	0.035	0.185	254	0.064	0.007	-0.209***	0.085	-0.127**	0.030	0.017	0.082	-0.101	0.120*	-0.010	0.115

Table 2
Correlations between control variables

	13	14	15	16	17
13) Male	-				
14) Age	0.240***	-			
15) Pre-university education	-0.023	-0.082	-		
16) Short or part-time program	0.102	**0.488*** **	0.025	-	
17) Narrow study field	-0.051	-0.034	**-0.459*** **	0.203***	-
18) Year of labour market entry 1995	0.101	-0.062	-0.210***	0.259***	0.005
19) Year of entry 1996	0.033	0.146**	0.262***	-0.147**	-0.082
20) Year of entry 1997	-0.112*	-0.087	0.300***	-0.286***	0.031
21) Year of entry 1998	-0.004	0.086	0.059	-0.046	0.070
22) Year of entry 1999	-0.014	-0.265***	-0.063	-0.339***	-0.021

* correlation is significant at 0.10 level, ** at 0.05, *** at 0.01

4 Results

Descriptives for all variables

Descriptive results for all variables in the research sample are presented in table 1 and 2.

The data indicate that the majority of the graduates is female; almost 88%. On a national level, female majorities in health education are a normal finding (see e.g. Allen, Ramaekers & Verbeek, 2000). Mean age at a year and a half after graduation is about 26 years. Having attended other than the regular educational Health Sciences program has been indicated by the 'short or part-time program' dummy variable, showing this is the case for 33% of our research sample. Because correlations between this variable and the final Progress test in the fourth year, as well as the nominal Group Functioning scores are rather high (.477*** and -.486***, respectively), we decided to leave this variable out of further analysis.[4] The Group Functioning scores are only available for a subset of the subjects (about 63%), and therefore presented and included in the analyses by three dummies: for the missing values, the high scores (above mean total amount of points), and the low scores (below mean total amount of points; reference category). Because the correlation between the dummy for Pre-university education and the Group Functioning Scores Missing-dummy is high (-.501***), a *multicollinearity* problem may occur. By comparing the separate and combined effects of the competence indicators on labour market outcomes, and switching the reference category

4. The research sample may be considered heterogeneous with respect to the type of program attended, but we chose not to leave out one third of the sample. The correlations with test scores may be explained by previously attended vocational programs or work experiences. In the research, the variables pre-university education versus other programs (dummy for highest level of secondary school) and relevant work experiences (dummy yes/no) control for this. Multicollinearity seems not to be present among the remaining variables. All estimates remain within the range of plus or minus one standard error.

from low GF scores to missing GF scores as a check, multicollinearity appears not to influence the results.[5]

To control for *selectivity* in our data, two issues should be considered: in the first place the characteristics of the research sample as such, and second, the possibly systematic processes underlying missing values in the educational competence indicators, and on labour market outcome indicators. With respect to the first selectivity issue, the sample has been taken from a Problem Based Learning (PBL) environment, in which curricula are organized around field related problems and issues. Students learn and work in tutorial groups, and self-directed learning is stimulated by the type of tasks and examinations, such as the Progress test and writing assignments. The PBL context can be considered an innovative learning context, in which the learning of generic competence is stimulated by its organization and curricular design (Savery & Duffy, 1995; Schmidt & Moust, 1998). This implies that students attracted to this type of education are possibly already more generically competent and/or develop generic competence more easily and integrated with the specific study contents, as compared to students from more traditional organized universities. Research among medical graduates reveals effectiveness of the integrated longitudinal approach in PBL with respect to the development of communication skills (Van Dalen, Kerkhofs, Van Knippenberg-Van den Berg, Van den Hout, Scherpbier & Van der Vleuten, 2002). This may be taken into account when interpreting our results.

With respect to the second selectivity issue (in the available educational data) we conducted several t-tests for the cases that are not included in the research sample because of missing values, versus the cases that remain available for analysis, in combination with labour market information. The results of these selectivity tests are presented and discussed in appendix 2. The findings indicate that the subjects that are included in the analyses score higher on Masters' theses, and on Group Functioning. To analyse the bias effect of the higher Masters' thesis results in the remaining sample, analyses have been checked for a larger sample with the lower scoring cases on the Masters' thesis as well. No other results were found as compared to our higher scoring sample. The higher Group Functioning scores seem mainly due to drop out during education. This may be a sign of a selective process during education on this type of competence. And it will turn out that the remaining Group Functioning scores have enough predictive power to assume selective processes related to this indicator after graduation, thus for the labour market, as well.

The descriptive statistics of our labour market outcomes in table 1 reveal that 90% of our responding subjects have a job, almost 54% an academic job, 77% a matching job, and the mean wages represent the log (ln) of the gross mean 10.59 euro hourly wage.

We now turn to the first labour market outcome analysis; what is the predictive effect of competence indicators on obtaining a job, a year and a half after graduation?

Effects of competence levels on obtaining a job

Our first labour market analysis is concerned with the chance of having a job, a year and a half after graduation, for those who are part of the labour force. Table 3 presents the results.

5. The estimates of the competence indicators all remain within ranges of plus or minus one standard error.

Table 3a
Regression estimates of the effects of competence indicators on having a job

	Model 1		Model 2		Model 3	
	B	s.e.	B	s.e	B	s.e.
Constant	3.242*	1.865	3.623	2.160	4.667**	2.271
Competence indicators						
Final Progress Test 4th year			0.341	0.252	0.917**	0.424
Relevant work experience during study			0.020	0.484	0.044	0.507
Masters' thesis result			-0.003	0.249	0.417	0.369
Managerial experience during study			-0.020	0.468	0.027	0.483
Group Functioning scores missing			-0.431	0.578	-0.513	0.587
Group Functioning scores high			0.439	0.709	1.031	0.892
Control Variables						
Male	0.591	0.795	0.657	0.815	0.788	0.826
Age	-0.032	0.065	-0.031	0.075	-0.062	0.075
Pre-university education	0.456	0.572	0.251	0.634	0.382	0.651
Narrow study field	-0.842*	0.466	-0,792*	0.478	-1,340**	0.602
Year of entry 1995	-0.268	0.681	-0.476	0.713	-0.060	0.742
Year of entry 1997	-0.586	0.611	-0.937	0.711	-1.104	0.734
Year of entry 1998	0.107	0.704	-0.290	0.792	-0.189	0.809
Year of entry 1999	infinite	∞	∞	∞	∞	∞
Interactions						
Narrow study field x Masters' thesis result					-0.819	0.509
Narrow study field x Progress Test result					-0.992*	0.539
Broad study field x high Group Functioning scores					-1.111	1.192
Model Statistics						
Number of cases (n)	250		250		250	
Model chi-square	8.909		12.461		19.718	
d.f.	8		14		17	
p	0.350		0.569		0.289	
Nagelkerke R2	0.073		0.102		0.159	

* significant at 0.10, ** at 0.05
Note 1: standardized values are used for final Progress Test scores and Masters' thesis results
Note 2: Year of entry 1996 is the reference category for the 'year of entry' control variables

As can be seen from table 3, a so-called narrow study field reveals to have a steady negative effect on having a job. In the second model, no effects are found for competence indicators on having a job. Including the interaction effects in model 3, a positive effect for the Progress test scores appears, together with a negative effect for those scores in a narrow study field, as compared to a broader study field. In terms of how large the effects are, we calculate the changes in the chance to find a job for this variable, based on the chance to find a job for a reference person[6] in model 3.

6. Our reference person is characterized by belonging to the *reference categories* of the dummy variables and having *mean scores* when relevant. Therefore our reference person is female,

The chance to find a job is expressed in chance model 4.1.

$$P_i = 1 / (e^{-(\alpha+\beta yz\ Xi)} + 1) \qquad (4.1)$$

Transforming our estimated logistic model 3 in table 3, the chance model 4.1 reveals a chance to find a job for our reference person of 95%.
The effect of having followed a narrow study specialization instead of a broader one, leads to a chance of 85%, which means a change of about -10% of finding a job compared to the reference person, keeping all other variables constant. The effects of the Progress test and the interaction effect of the Progress test with narrow study field lead to changes in the chance of obtaining a job of + 3% and – 6,5% respectively. This means that the effect of the Progress test scores is positive in a broader study field and negative in a narrower study field. These results are summarized in table 3b.

Table 3b
Changes in the chance to obtain a job for different values of the relevant variables

	Model 3 of Table 3
Chance for the reference person:	95 %
Changes in chance for	
Narrow study field (1/0), with reference category is broad study field	-10 %
Progress Test scores (standardized scores with mean=0 and sd=1)	+ 3 %
Progress Test scores x narrow study field (interaction term)	- 6.5 %

Effects of competence levels on obtaining an academic job

The effects of competence indications on obtaining an academic job are presented in table 4.

In the first model, a negative effect of age and the entry year 1995 are found, as well as a positive effect of entry year 1998. In the second model, including the competence indicators, positive effects are found for higher Masters' thesis results, having attained managerial experience during education and the higher (and missing) Group Functioning scores as compared to the lower scores. No effects are found for the narrowness of the study field. In the third model, no interaction effects appear to be significant, while the main effect of Masters' thesis result now drops just below the 0.10 significance level. The significance of the effect of the high Group Functioning scores has disappeared after introducing the interaction term with broad study field. And the estimate (and effect) of high Group Functioning scores itself is much smaller, because of controlling for this interaction term. The third model does in fact not add much information (see also the model statistics). In terms of what the effects mean for the changes in the *chance* to obtain an academic job, we calculate

ages 26 years, followed other than pre-university education before entering the Health Sciences program, entered the labour market in 1996, obtained no working nor managerial experience, followed one of the broader study specializations, and scored average on all educational competence indicators.

these changes for our reference person again, based on the estimates in model 2 with main effects. The results are presented in table 4b.

Table 4
Regression estimates of the effects of competence indicators on obtaining an academic job

	Model 1		Model 2		Model 3	
	B	s.e.	B	s.e		
Constant	3.319**	1.376	1.483	1.519	1.262	1.518
Competence indicators						
Final Progress Test 4th year			-0.010	0.162	-0.061	0.197
Relevant working experience during study			0.196	0.332	0.223	0.335
Masters' thesis result			0.465***	0.169	0.322	0.196
Managerial experience during study			0.650**	0.314	0.656**	0.319
Group Functioning scores missing			0.710*	0.390	0.715*	0.391
Group Functioning scores high			1.137**	0.452	0.677	0.648
Control Variables						
Male	0.343	0.447	0.277	0.485	0.259	0.489
Age	-0.127**	0.050	-0.096*	0.056	-0.089	0.056
Pre-university education	-0.212	0.353	0.122	0.419	0.103	0.419
Narrow study field	0.335	0.305	0.376	0.337	0.626	0.419
Year of entry 1995	-0.886*	0.522	-0.484	0.557	-0.601	0.577
Year of entry 1997	0.034	0.383	-0.448	0.453	-0.425	0.456
Year of entry 1998	1.030**	0.407	0.826*	0.466	0.790*	0.469
Year of entry 1999	0.477	0.729	-0.122	0.855	-0.005	0.855
Interactions						
Narrow study field x Masters' thesis result					0.534	0.381
Narrow study field x Progress test score					0.183	0.356
Broad study field x Group Functioning high scores					0.690	0.783
Model Statistics						
Number of cases (n)	232		232		232	
Model chi-square	24.562		52.373		55.025	
d.f.	8		14		17	
p	0.002		0.000		0.000	
Nagekerke R2	0.134		0.270		0.282	

Note 1: standardized values are used for the final Progress Test scores and the Masters' thesis result
Note 2: Year of entry 1996 is the reference category for the 'year of entry' control variables

Table 4b
Changes in the chance to obtain an academic job for different values of relevant variables

	Model 2 of Table 4
Chance for the reference person:	
Changes in chance for	26 %
Masters' thesis results, with standardized mean=0, and sd =1	+ 10 %
Managerial experience (1/0), with reference category is no experience	+ 14 %
High Group Functioning scores (1/0), with reference category low scores	**+ 26** %

Effects of competence levels on obtaining a matching job for study field

The effects of competence indicators on obtaining a matching job are presented in table 5.

Table 5
Regression estimates of the effects of competence indicators on obtaining a matching job

	Model 1		Model 2		Model 3	
	B	s.e.	B	s.e	B	s.e.
Constant	0.054	1.484	1.257	1.687	0.950	1.706
Competence indicators						
Final Progress Test 4th year			0.426**	0.208	0.260	0.234
Relevant working experience during study			0.117	0.382	0.120	0.385
Masters' thesis result			0.446**	0.200	0.363	0.225
Managerial experience during study			-0.159	0.362	-0.177	0.371
Group Functioning scores missing			-0.732	0.464	-0.719	0.466
Group Functioning scores high			-0.358	0.524	-0.954	0.837
Control Variables						
Male	0.396	0.571	0.598	0.608	0.543	0.608
Age	0.040	0.053	0.015	0.060	0.026	0.061
Pre-university education	0.549	0.425	0.460	0.476	0.458	0.478
Narrow study field	0.588	0.369	0.744*	0.396	1.426**	0.685
Year of entry 1995	0.646	0.709	0.609	0.750	0.528	0.763
Year of entry 1997	-1.149**	0.455	-1.318**	0.528	-1.305**	0.529
Year of entry 1998	-0.511	0.478	-0.677	0.564	-0.740	0.562
Year of entry 1999	-2.545***	0.796	-2.791***	0.864	-2.723***	0.871
Interactions						
Narrow study field x Masters' thesis result					0.476	0.504
Narrow study field x Progress test score					0.781	0.507
Broad study field x Group Functioning scores high					0.686	0.951
Model Statistics						
Number of cases (n)	231		231		231	
Model chi-square	18.346		33.944		37.327	
d.f.	8		14		17	
p	0.019		0.002		0.003	
Nagelkerke R2	0.116		0.207		0.226	

Note 1: standardized values are used for final Progress Test scores and Masters' thesis results
Note 2: Year of entry 1996 is the reference category for the 'year of entry' control variables

Negative effects are found for the years of labour market entry 1997 and 1999. In the second model, positive effects are found for the Masters' thesis results and the Progress test scores. Also a positive effect is found for the narrower study fields, when controlled for competence indicators. Later labour market entry years reveal negative effects. Including the interaction effects in model 3 does not add much information compared to model 2. The significance of the Masters' thesis result drops just below the 0.10 level again. The significant effect of the Progress Test has disappeared. We therefore illustrate the changes in chances to obtain a matching job based on the differences in the relevant competence variables of model 2 for our reference person, in table 5b.

Table 5b
Changes in the chance to obtain a matching job for different values of relevant variables

	Model 2 of Table 5
Chance for the reference person:	84 %
Changes in chance for	
Progress Test scores with standardized mean=0 and sd =1	+ 5 %
Masters' thesis results, with standardized mean=0, and sd=1	+ 5 %
Narrow study field, with reference category is broad study field (1,0)	+ 7.5 %

Effects of competence levels on wage

The effects of competence indications on wage are presented in table 6. The most extreme outliers in wages have been left out of analysis (n=5). PhD students are left out of this analysis as well, since their wage is kept low by contract.

As can be seen from the table, age has a positive effect on wage. Later labour market entry years also reveal positive effects. A negative effect is found for the narrower study fields, however. In the second model, only a positive effect of relevant work experience appears, in addition to the effects of the control variables from the first model. In the third model, no extra effects are found for the academic level of the job, or for jobs matching the study field. Including the interaction terms, the effect of an academic job becomes significantly positive.[7] Also a positive effect of high Group Functioning scores appears, in combination with a negative effect of these scores in broader study fields as compared to those in narrow study fields.
This time the interaction model reveals extra information in addition to a model with only main effects. Therefore we calculate the changes in wage for the relevant variables again for our reference person, based on model 4. The results are presented in table 6b.

7. The interaction effects of competence indicators with types of jobs (academic and matching) have been estimated as well, but did not reveal new or extra information. Therefore this estimation is not presented separately.

Table 6
Regression estimates of the effects of competence indicators on gross hourly wages (log)

	Model 1		Model 2		Model 3		Model 4	
	B	s.e.	B	s.e	B	s.e.	B	s.e.
Constant	1.785***	0.129	1.788***	0.145	1.756***	0.148	1.785***	0.147
Competence indicators								
Final Progress Test 4th year			0.003	0.016	0.003	0.016	-0.001	0.019
Relevant working experience during study			0.055*	0.031	0.056*	0.031	0.054*	0.031
Masters' thesis result			-0.013	0.016	-0.016	0.017	-0.002	0.018
Managerial experience during study			-0.002	0.030	-0.011	0.031	0.000	0.031
Group Functioning scores missing			-0.016	0.038	-0.026	0.038	-0.029	0.038
Group Functioning scores high			0.057	0.043	0.045	0.044	0.193***	0.067
Control Variables								
Male	0.021	0.042	0.034	0.043	0.027	0.044	0.026	0.043
Age	0.021***	0.005	0.021***	0.005	0.023***	0.005	0.022***	0.005
Pre-university education	0.017	0.036	-0.007	0.04	-0.008	0.040	-0.006	0.039
Narrow study field	-0.179***	0.032	-0.178***	0.033	-0.175***	0.033	-0.241***	0.041
Year of entry 1995	-0.067	0.051	-0.066	0.053	-0.058	0.053	-0.043	0.053
Year of entry 1997	0.166***	0.039	0.147***	0.043	0.148***	0.044	0.138***	0.043
Year of entry 1998	0.253***	0.040	0.231***	0.045	0.221***	0.045	0.214***	0.045
Year of entry 1999	0.143*	0.069	0.116	0.074	0.095	0.077	0.052	0.077
Academic job					0.050	0.033	0.060*	0.033
Matching job					-0.036	0.038	-0.043	0.038
Interactions								
Narrow study field x Masters' thesis result							-0.059	0.038
Narrow study field x Progress test score							-0.002	0.035
Broad study field x high GF-score							-0.219***	0.075
Model Statistics								
Number of cases (n)	187		187		187		187	
Adj. R^2	0.421		0.421		0.423		0.442	
F	17.902		10.664		9.523		8.746	
p	0.000		0.000		0.000		0.000	

Note 1: standardized values are used for the Progress Test scores and the Masters' thesis results
Note 2: Year of entry 1996 is the reference category for the 'year of entry' control variables

Table 6b
Changes in the wage for different values of relevant variables

	Model 4 of Table 6
Gross hourly wage for the reference person:	10.65 euro
Changes in wage for	
Relevant work experience, dummy for yes (1), no=0	
	+ 0.59 euro
Academic job, dummy for academic=1 versus lower levels=0	+ 0.66 euro
High Group Functioning scores (1/0) with reference category low scores	+ 2.27 euro
Narrow study field, with reference category is broad (1,0)	- 2.28 euro
Interaction Broad study field x high Group Functioning scores	- 2.10 euro

Summary of results

In table 7 the significant results of this study are presented together.

Table 7
Summary of significant results

	having a job	academic job	matching job	wages
Competence indicators				
Progress test scores	(+)		+	
Working experience				+
Masters' thesis result		+	+	
Managerial experience		+		
Group Functioning scores		+		(+)
Control variables				
Narrow study field	-		+	-
Age		-		+
Interactions				
Narrow study field x Progress test scores	-			
Narrow study field x Masters' thesis result				
Broad study field x Group Functioning scores				-

For obtaining a job, no single competence indicator has a significant main effect. Having attended a broader study program seems positive, however. For the other labour market outcomes, competence of students is relevant with mostly main effects: a higher Masters' thesis result is enhancing the chances to obtain an academic and a matching job, as expected, but does not lead to a higher wage. Managerial experience is relevant for obtaining an academic job. However, high Group Functioning scores seem to double the chances for a higher level (academic) job compared to subjects with low Group Functioning scores. These effects appear to have consequences for the wage as well; when controlling for interaction effects, both Group Functioning scores and the academic level of the job are positively related to wage. Higher Progress test scores having predictive value for obtaining a matching job. This is in line with our expectation and the findings of Heijke, Meng and

Ramaekers (2003), that more specific competence enhances the chance to obtain a matching job. A narrow study field enhances the chance for a matching job as well. It is argued that in narrow programs the emphasis is more on specific competence (Heijke & Meng, 2003), which in turn can enhance the chance for a matching job. However, no higher wage is found for matching jobs, which is in fact unexpected and in contradiction with matching theory that these jobs are better paid because of the direct productivity the worker can display. Work experience and ageing are leading to a higher wage, whereas a narrower study field leads to a lower wage. It seems that fluctuations in labour demand and supply play an important role, especially in the narrower study fields. Labour market entry years have considerable effects on labour market outcomes and the interactions between type of study field and competence indicators appear especially relevant for job chances and economic returns.[8]

5 Conclusion

In this paper, we analyse the effects of different competence indicators, both specific and generic types of educational competence, on labour market outcomes of graduates in Health Sciences. The aim of this empirical study has been to offer information on what types of competence students develop in education and what value these competences have for the labour market apart from more traditional human capital variables, such as work experience and managerial experience. The research question is: to what extent do specific and generic indicators of competence predict labour market outcomes?
A number of conclusions can be drawn.

First, the results suggest that, especially for the quality of work (indicated by job level, horizontal mismatch and wages), educational competence of students is relevant and the indicators reveal a differentiated pattern. The Masters' thesis result, referring to the most integrated measurement of competence in this study, seems to have predictive value for both level and matching type of job. Furthermore, there is a tendency for specific indicators to be relevant for matching jobs, and generic indicators for obtaining higher level jobs. These findings are in line with other labour market studies that consider specific and generic competences retrospectively, by self-reports of graduates in a labour market survey (see e.g. Heijke, Meng & Ris, 2003; Heijke, Meng & Ramaekers, 2003).
Second, graduates differ in more aspects than is usually measured with traditional 'knowledge' and 'skills' tests. The high Group Functioning scores reveal large effects on labour market outcomes, which are independent of the other test scores. The instrument seems to distinguish the academic level workers from the non-academic level workers very well. This may be explained by the fact that scoring high on Group Functioning, reflecting a high participation in group discussion, the ability to work in a team and a good presentation of information and knowledge, refers to a pro-active attitude and a tendency to take

8. Labour market demand and supply fluctuations seem larger and therefore more significant for narrow study fields than for broader fields as can be illustrated for different types of academic studies, including our Health Sciences graduates, based on the data as used for ROA reports on employment and education (e.g. Allen, De Jong, Roeleveld, Verbeek & De Vries, 2003).

responsibility for successful functioning of the group. Note that only the better students can obtain a point per course period. We think the aspects underlying the GF-scores contribute to an academic working attitude and therefore help to obtain an academic level job after education. Both self-selection and selection by employers may play a role in this process.

Third, the results with our Health Sciences sample seem to indicate that a narrow study field rewards its students with a better matching job, although they must look harder to find this job, and their wages are likely lower than those of their broader educated health sciences colleagues. Apparently, these graduates are more motivated to find such a matching job and are willing to wait longer and being paid less. This effect may point to a differentiation in intrinsic and extrinsic rewarding study fields, which can be relevant information for starting health sciences students. However, labour market demand and supply fluctuations are likely to play a role as well. In the first years of the nineteen nineties there was a period of high unemployment. And as long as the labour market demand is poor for academics, they seem to obtain jobs at a lower level (paying less) and outside their own domain (ROA, 2002). In the second half of the nineteen nineties the labour market demand recovered, especially for the higher educated. Our results indicate that the later years of labour market entry (in the second half of the nineteen nineties) have positive effects on labour market outcomes, which reflects this increasing labour demand. However, the increasing demand seems to be the most profitable for the broader study fields. For graduates of narrower programs there is only an advantage in chances to find a matching job. It could therefore be argued that the recovering labour market demand has not (yet) reached the narrower domains and these graduates need to wait for better times and better wages, because they lack the flexibility to obtain other jobs, outside their own domain. From the perspective of an educational program, a lack of flexibility of its graduates on the labour market may be considered counter-productive. Already since the 1980s all graduates have a general broader orientation on the labour market. This is related to a larger need for and emphasis on employability and flexibility for the labour force in general (Versloot, Glaudé & Thijssen, 1998).

Related to future research, it seems valuable to continue research into the effects of educational competence indicators on labour market outcomes. Available competence instruments and other measurements of knowledge and skills from daily practice of modern education need to be explored for their predictive value for labour market outcomes and functioning of graduates. Thereby the research can build on the availability of empirical data and contribute to the debate about what types of competence graduates need the most for work and how to measure them. Not only short term, but also longer-term labour market outcomes are of importance. What, for example, would the predictive effect of our instruments be on longer-term labour market success? And what are the effects of the indicators for other research samples, from other study fields, or from other learning environments than PBL curricula? Other indicators of labour market success, such as further learning possibilities, or the achievement of personal career goals could be interesting as well, to enlarge the value of the research outcomes for other research domains.

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Appendix 1

Type of jobs (in percentages) of 2336 graduates in Health Sciences, graduated in 1984-1995*.

Type of job in %	Management of HS	Biological HS	Movement Sciences	Mental HS	Health Promotion & Education	Nursing Sciences	Theory of HS
Researcher	9.1	**53.6**	**28.6**	**24.1**	**23.3**	**11.4**	**39.2**
Policy maker	**37.1**	7.1	8.8	5.5	**11.7**	**20.5**	**13.5**
Management job	**14.3**	1.1	3.1	3.6	4.6	**24.3**	5.4
Teacher	2.5		5.7	3.6	5.3	9.4	5.4
Consultant/Advisor	**9.5**	2.7	4.4	2.3	6.3	3.5	1.4
Commercial jobs	8.6	4.4	5.3	2.7	4.4	1.3	1.4
Health promotion/prevention jobs	0.4	0.5	0.4	3.2	**20.6**	0.5	
Psycho-social therapist	0.7		0.4	**26.8**	2.7	1.1	2.7
Sales jobs	3.4	5.5	5.3	2.7	3.9	1.7	1.4
IT-expert	2.5	1.1	0.9		0.7	0.3	1.4
Nurse	1.6	1.1	0.4	6.8	2.4	**22.1**	**10.8**
(Human) Movement therapist	0.5		**15.4**		0.7		2.7
Other	4.1	**10.9**	4.4	5.0	5.3	1.9	4.1
Study	2.2	6.0	7.0	7.3	3.4	0.3	1.4
No job	3.4	6.0	9.7	6.3	4.6	1.7	9.0
N	**558**	**183**	**227**	**220**	**412**	**752**	**74**

*Source: Faculteit der Gezondheidswetenschappen, afd. Voorlichting en PR (1996). Onderzoek arbeidsmarktpositie afgestudeerden. Rijksuniversiteit Limburg, Maastricht. *[Faculty of Health Sciences, Dep. of Promotion and PR (1996). Study into the labour market position of graduates. Rijksuniversiteit Limburg, Maastricht.]*

Appendix 2

Selectivity bias in the educational data of the research sample: availability of cases and the choice for the study sample

The selectivity of the educational data of (graduated) health scientists can be presented in a stepwise method. In every step, a certain amount of the cases become unavailable for analysis, and selection bias must be considered. Table I presents the steps in the (un)availability and the differences in scores of the remaining cases (group A/B/C).
We took the (un)availability of the most systematically gathered assessments (Masters' thesis and Progress test score) as a reference point, because the Group Functioning scores are only available for the 1992 and 1993 cohort, since they have been gathered from the year 1992 on.

Table I
Availability of educational data for health scientists and differences in scores of the sub-groups

Starting cohorts Health Sciences students 1991-1993: n=1611
No information on Masters' thesis result or Progress Test: n=521 (drop-out)
Remaining cases: **n=1090**, divided into groups A, B, C (*explanation in text*):

	Group A	ANOVA	**Group B**	ANOVA	**Group C**
mean/sd:	n=156	*F/p*	n=432	*F/p*	n=502
MT result	-		3.42/0.34	*5.776/**0.016***	3.47/0.34
PT score	13.02/5.86	*2.281/0.131*	-		13.84/5.92
GF score	3.46/2.82 n=41	*9.080/**0.003***	5.42/3.71 n=92	*0.034/0.854*	5.34/4.02 n=308
ANOVA F/p (GF/AC):		*8.364/**0.004***			
Approached for Labour Market Survey:					
1994	n=0		n=19		n=0
1995	n=0		n=75		n=0
1996	n=0		n=74		n=33
1997	n=3		n=52		n=189
1998	n=9		n=32		n=126
1999	n=8		n=22		n=120
2000	n=3		n=5		n=26
2001	n=12		n=2		n=1
2002	n=5		n=0		n=0
2003	n=3		n=0		n=0
Totals in %	Group A: 27,5%		Group B: 65%		Group C: 98,6%

Our analysis starts with the cohorts of Health Sciences students that started their studies in the years 1991-1993, selected on their identification numbers corresponding with these years (n=1611). For n=521 of them, no scores for Masters' theses or final Progress tests in the

fourth year of study are available. A check of the labour market information in the ROA datasets for graduation years 1992-2002 reveals that for 91% of these 521 students, no graduation has been reported. This means these 521 cases may be considered drop-out, which implies the students did not finish their studies, or turned to another study than Health Sciences (e.g. Medicine).

The remaining 1090 cases can be divided into three groups: for n=156 the final Progress test score is available, but the Masters' thesis result is not. These n=156 are considered group A. From the ROA labour market datasets it appears that 27.5% of them have been graduated, so these missing Masters' thesis results can be considered missing values in the dataset. For the remaining 72.5 %, no labour market information can be traced, thus these missing Masters' thesis results refer to non-graduation (drop-out in a final stage of the study). For the second group, of n=432, Masters' thesis results are available, but final Progress test scores are not. These cases are considered group B. Although all these students are presumably graduated, only 65% can be traced in the graduation cohorts as available at ROA in the labour market surveys. The other 35% is not traceable. The students for which both the Masters' thesis result and the final Progress test score are available, are considered group C (n=502). All of these students are graduated and inquired for their labour market information with the ROA labour market surveys in the years 1996-2001. The non-response on the labour market survey in group C can therefore be considered pure non-response; no other selection mechanism is present here. Our main interest for the purpose of our study is in group C, since these data are most complete. However, based on the large amount of (graduated) subjects in group B, it could be interesting to take these cases into account as well. It must be noted however, that the missing final Progress tests in group B are to a certain extent the consequence of the shorter or part-time programs followed by many of the students in this group, which makes them different from the most 'normal' (4 years) doctoral students of group C. This is also visible from the years in which the labour market survey has been sent to them; for n=75 this was done in 1995 already, implying a shorter program of at least minus one year for subjects in group B. The differences in scores on the educational competence indicators reveal that the subjects in group C score higher on the Masters' thesis, which may have consequences for the effects found when only including this group. To check fully for the consequences of the selection bias caused by choosing group C instead of groups B+C in our analyses, we conducted our analyses twice: once for the cases of group C, and once for the cases of group B and group C together, in so far that labour market information of the years 1996-2000 has been used, to cover for most cases in relation to a reasonable amount of control variables for years of labour market entry. We did this for all available matching variables in both groups. It appeared that the effects of our competence indicators on labour market outcomes were not different. Therefore we decided to only present the results with group C of n=502 in the results section of the paper.

As a final step, we now consider the differences in scores on the educational competence indicators between the respondents to the labour market survey versus the non-respondents of group C in table II.

Table II.
Selection bias in educational data of the sample (n=502) due to non-response on the labour market survey

Response on the labour market survey group C	Yes=Group1 Mean	Sd group 1	No=Group 0 Mean	Sd group 0	t-test F	p
Master' Thesis result	n=282	0.333	n=220	0.348	0.902	0.343
Progress Test scores	3.485	5.903	3.451	5.926	0.059	0.808
Group Functioning scores	n=282	4.047	n=220	3.768	3.782	0.053
	14.160		13.423			
	n=176		n=132			
	6.085		4.341			

Table II reveals only higher scores on group functioning at the 0.10 level for the respondents to the labour market survey compared to the non-respondents. Therefore bias in the scores as caused by non-response seems minimal. The response rate of 54% is consistent with the separate annual response rates on the national level with the labour market survey (see also Allen et al., 2000). However, this type of selection bias (non-response) may affect our study outcomes in a way we can not easily predict. It is possible that the lower scoring non-responding individuals are less motivated to respond because their labour market outcomes are poorer. But on the other hand, the non-responding may also be related to different factors, not in relation to educational achievement scores, nor to labour market outcomes (see e.g. Huijgen & Wolbers, 1999; Huijgen, 2002).