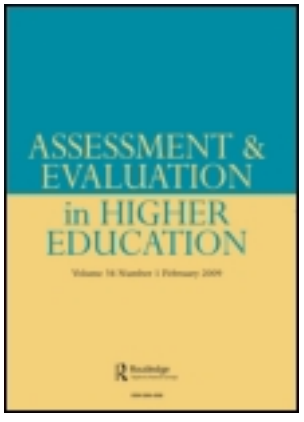

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The relationship between perceived competence and earned credits in competence-based higher education

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We explored how two types of study outcomes, perceived competence and earned credits, are interrelated, and influenced by self-regulation, motivation (intrinsic value and expectancy of procrastination) and deep approach to learning. The relationships between these variables were analysed in a sample of 894 first-year Dutch university students, using linear structural modelling. Results show that learning process factors play other roles in explaining perceived competence than in explaining earned credits. Perceived competence and earned credits, as two sides of the same coin in competence-based education, are only weakly related. Furthermore, this study shows that it is most likely that perceived competence affects earned credits, but a model in which earned credits affects perceived competence as possible causal relationship was also accepted, although the relationship remains weak. The practical implication of this study is that, as long as perceived competence and the number of credits are not related, competence-based higher education will not obtain optimal efficiency. For participants and researchers in higher education, it remains important to be aware that different learning goals may evoke different study behaviours in students, and the challenge for higher education is to align these goals.

Keywords: self-regulation; motivation; deep approach to learning; earned credits; perceived competence

Introduction

As in many other countries, Dutch universities must cope with low efficiency figures (Dutch Inspectorate of Education 2009). Important reasons for non-completion that are frequently distinguished are: the wrong choice for a programme in higher education; social factors, such as lack of integration and commitment; learning process factors, such as lack of motivation, self-regulation and wrong approach to learning and lack of study skills (Covington 2000; Eccles and Wigfield 2002; Onderwijsraad 2008; Robbins et al. 2004; Tinto 1993; Yorke and Longden 2008). In this study, we have a closer look at the relations between three learning process factors, with two types of study outcomes of higher education.

Kamphorst et al. (2009) compared two models and concluded that learning process factors play different roles in explaining perceived competence or earned credits, i.e. intrinsic value, self-regulation and deep approach to learning were important factors in explaining perceived competence; procrastination, self-regulation and intrinsic value affected earned credits. In the present study, we will elaborate on this

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conclusion with the purpose to develop one conceptual model in which learning process factors and the two study outcomes are related. Strong direct relationships between the two study outcomes resulting from the same learning process may indicate that perceived competence is in line with earned credits. The model is tested on a sample of freshmen in a Dutch university.

Theoretical framework

Competence-based education (CBE) is an umbrella term for all teaching approaches which use competences as a starting point for determining the goals and contents of education. Many universities have introduced CBE in response to problems related to dropout and slow academic progress. Competences are related to constructivist and active learning, consisting of components such as self-regulation, intrinsic motivation and a deep approach to learning (Van der Klink, Boon, and Schlusmans 2007). We will use the following definitions of these concepts. Self-regulation is the extent to which a person perceives him/herself as capable of exercising influence over motivation, thinking, emotions and the behaviour that is connected to these factors (Boekaerts 1999). This capability involves that a student is aware of, and able to manage and control, his/her learning process, and knows when to use varying cognitive strategies in order to conduct a learning task (Entwistle and Peterson 2004; Pintrich and De Groot 1990). Motivation, the second concept, is what drives people to action (Eccles and Wigfield 2002). Motivation is related to the purposes and goals, the learning intentions and challenges, the personal drives, as well as the intrinsic and extrinsic properties, of the (set of) task(s) that a student is pursuing (Hattie 2009). Two aspects of motivation that are distinguished in the expectancy-value theory of motivation are intrinsic value and expectancy of procrastination (Eccles and Wigfield 2002). Intrinsic value is the extent to which a person perceives a certain task as joyful, valuable, pleasant and has interest in the task. The expectancy-aspect 'procrastination' is the personal trait or tendency of a person to delay study activities that have to be completed (Schraw, Wadkins, and Olafson 2007). Deep approach to learning, the third concept, is the intention of a student to understand learning tasks, combined with specific learning activities (e.g. applying ideas, checking evidence, repeating, selecting, relating with previous and new knowledge and structuring) (Bruinsma 2004; Entwistle and Peterson 2004). These three concepts together are components of a characteristic model that Entwistle and Peterson (2004) identify as 'meaning-directed learning'.

Meaning-directed learning of students is supposed to be stimulated in CBE-based programmes, because the programme contents are less fragmented compared to the more traditional curriculum in universities, and more based on authentic tasks and problems (Martens and Boekaerts 2007). Furthermore, many studies showed that the components of meaning-directed learning have impact on academic progress (e.g. Bruinsma 2004; Entwistle and Peterson 2004; Vermunt 2005). For example, a high degree of intrinsic value as well as a low degree of procrastination are related to study success in terms of course grades, completion of assignments or overall achievement (e.g. Bruinsma 2004; Eccles and Wigfield 2002; Schraw, Wadkins, and Olafson 2007). Also, a deep approach to learning has impact on learning outcomes (Entwistle and Peterson 2004). However, Bruinsma (2004) found a negative relationship between a deep approach to learning with earned credits; whereas Vermunt (2005) found a positive influence of this variable

on performance, e.g. as measured by mean exam scores. These different relationships may be caused by different definitions of study outcomes. Earning credits is more related to outperforming others and superficial, rote-level processing of information, whereas acquiring competence appeals more to one's understanding and appreciation for what is being learned, combined with more deep-level, strategic processing of information (cf. Covington 2000). Vermunt's (2005) domain-specific learning outcomes may have been more inviting for meaning-directed learning than the number of credits in Bruinsma's (2004) study. Finally, self-regulation affects both motivation and a deep approach to learning, and thus also affects academic performance (Bruinsma 2004; Vermunt 2005).

In this study we distinguish between quantitative and qualitative types of study outcomes. Earned credits are a more objective, quantitative aspect, and perceived competence a more subjective, qualitative aspect of study success. This distinction is related to, although not the same as, Covington's (2000) distinction in learning/performance goals.

The hypothesised relationships between meaning-directed learning factors and study outcomes are summarised in the conceptual model (Figure 1).

The research questions that were derived from the above are:

(1) Does the model give an adequate representation of the relations between the discussed theoretical concepts? We hypothesised that (hypothesis 1a) a high degree of self-regulation leads to higher intrinsic value and lower procrastination, and contributes to a deep approach to learning (Bruinsma 2004; Entwistle and Peterson 2004; Pintrich and De Groot 1990; Vermunt 2005); (hypothesis 1b) meaning-directed learning will have an impact on the number of earned credits (Entwistle and Peterson 2004; Pintrich and De Groot

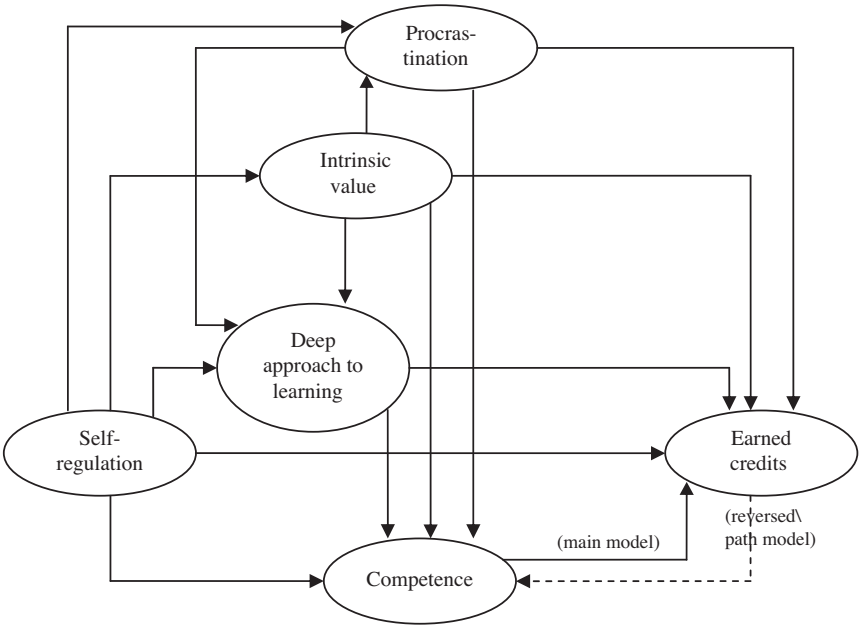

Figure 1. Conceptual model.

1990) as well as on competence (Covington 2000; Pintrich 1999; Vermunt 2005); in the cases of procrastination and deep approach to learning, these influences on earned credits will be negative (Bruinsma 2004).

(2) What is the exact nature of the relationship between earned credits and perceived competence? The relationship between the two types of outcomes is not investigated in extent (Robbins et al. 2004). In CBE, credits earned will be the result of several types of assessment: multiple choice tests, essays, self-, peer- and co -assessment (Dochy, Segers, and Sluijsmans 1999). However, we did not have specific information on the composition of the number of credits. That is, the total number of credits conceals how many credits were awarded for mastering specific competencies, completing assignments, participation in group work, knowledge examinations or skills. We assumed that on average, students in competence-based programmes will have a good perception of their competence. We expected a relationship between the two types of outcomes. That is, both outcomes can be traced back to the same meaning-directed learning factors (Dochy, Segers, and Sluijsmans 1999). The strength of this relationship will indicate how far this expectation can be confirmed. We hypothesised two possibilities (Marsh and Yeung 1997; Phan 2010): perceived competence influences earned credits (hypothesis 2a); the number of credits earned influences perceived competence (hypothesis 2b). Hypothesis 2a will be referred to as the main model. This model assumes that students first attain a certain level of perceived competence, which affects the number of credits earned. Hypothesis 2b, referred to as the reversed path model, is different from the main model in assuming that the number of earned credits precedes the attainment of a certain level of perceived competence.

Method

Population and sample

Data of first-year university students were used. A mail with a link to an online questionnaire was sent to 3572 first-year students; 894 students responded by filling out and returning the questionnaire. The advantage of online data collection is that all members of the population can be reached, provided that the email addresses used are accurate. Accuracy was guaranteed, because email addresses were frequently used by the programmes for educational purposes, such as delivery of learning materials, assignments, feedback and notifications of academic and social events. However, respondents of student surveys are more likely female and socially engaged (Porter and Whitcomb 2005), as well as more committed to programme evaluations, and more satisfied with the delivery of education (Kamphorst and Oostindiër 2008).

We can conclude that female and younger students are slightly overrepresented in the sample, but in general it reflects the diversity of the population with regard to the characteristics gender, sector of the programme and age (see Table 1).

The degree programmes of the six sectors were all competence-based. The degree programmes belong to one institution for higher vocational education, which adopted CBE as the leading paradigm for innovation of the curricula since about 2000. That is, all programmes are based on principles such as learning activities taking place in authentic situations, self-responsibility and self-reflection of

Table 1. Background information of the sample.

	Population		Sample	
Variable	No	%	No	%
Male	1768	49.5	366	40.9
Female	1804	50.5	528	59.1
<18 years	199	5.6	74	8.3
18–19 years	1778	50.1	558	62.8
20–21 years	1092	30.8	177	19.9
>22 years	478	13.5	80	9.0
Missing	25	–	5	–
Economics	966	27.0	173	19.4
Engineering	946	26.5	214	23.9
Health	572	16.0	216	24.2
Social work	563	15.8	126	14.1
Arts	122	2.8	66	7.4
Education	403	11.5	99	11.1

students and teachers' roles defined as coach and expert (Wesselink et al. 2007). In spite of variations due to disciplinary differences (Neumann, Parry, and Becher 2002) and different levels of implementation, the more than 60 accredited programmes in this institution reflect the general picture that higher vocational education in The Netherlands has integrated CBE in their curricula (Mulder, Weigel, and Collins 2007).

Instruments

After nine months of study, first-year students were asked to look back and provide information on their learning strategies and their self-perception of competence at that moment. The data on self-regulation, intrinsic value, procrastination, deep approach to learning and perceived competence, were captured in 36 items. All items were rated on a four-point (1–4) Likert scale, with higher scores indicating that the respective items were more applicable to the respondent. The items on self-regulation were based on a scale reported by Schwarzer and Jerusalem (1999). The items on intrinsic value, procrastination and deep approach to learning were based on the self-report questionnaire on deep information processing (Bruinsma 2004; Schouwenburg 1994). Although Bruinsma's questionnaire had somewhat different theoretical roots, its items on information processing coincided with our understanding of deep approach to learning. The concept of competence consists of many dimensions (e.g. behaviour–capability, knowledge–ability and specific–general) and can, accordingly, be defined in many ways (Mulder, Weigel, and Collins 2007). In this study, we used a definition of perceived competence with a restricted range, as the self-assessed capacity to execute job tasks, independently or in cooperation with other students. Students were asked to self-assess their competence in five items. We included items such as 'together with other students I am able to solve problems that occur in this profession', and 'I already master quite some competencies of this profession'. Thus, students were allowed to have their own discipline- or profession-specific associations with each item. This generic or holistic approach (cf. Baartman and Ruijs 2011) was appropriate to obtain an indication of the perceived competence level of a very diverse student group across different disciplines.

Table 2. Variables, item examples, number of items per scale, Cronbach's alphas, means and standard deviations.

Variables	Example item	*N* of items	Cronbach's alpha	*M*	SD	% positive (>2.5)
Self-regulation	I can concentrate on one activity for a long time, if necessary	7	0.83	2.64	0.46	62.2
Intrinsic value	Certain aspects of my study course are really interesting	5	0.80	3.18	0.48	91.5
Procrastination	I cannot get myself down to work hard enough	12	0.88	2.32	0.47	70.1
Deep approach to learning	It is important for me that I can understand a line of reasoning and its underlying meaning	7	0.78	3.07	0.40	92.6
Competence	I have the feeling I am able to conduct some professional tasks	5	0.68	2.89	0.44	87.9
Earned credits	Credits earned during the first year	1	–	53.1	8.97	91.9[a]

[a] $\geqslant 40$

Based on factor analysis, with principal component analysis and varimax rotation, the five hypothesised factors were distinguished, with factor loadings varying from 0.40 to 0.80. The scales were internally consistent, with Cronbach's alphas between 0.68 and 0.88 (Table 2). Earned credits were measured at the end of the first year, after 12 months of study, and include credits attained after resits. The data on earned credits were obtained from the student administration. The study outcomes are registered in European Credit Transfer System (ECTS) credits. The number of credits expresses how many modules, assignments and examinations students have completed. Students can earn 60 credits in one year. A minimum of 40 credits in the first year is required for continuation of the programme in the second year.

The table shows that the meaning-directed learning components we distinguished have been put to practise to a reasonable degree and led to satisfactory outcomes. On an average, students had neutral levels of self-regulation and procrastination (means of 2.64 and 2.32, respectively), positive scores on perceived competence (mean of 2.89), as well as positive levels of intrinsic value and deep approach to learning (scores > 3.0). On an average, respondents earned 53 credits at the end of the first year. Enough credits (40 or more) were earned by 91.9% of the respondents.

Analysis

We wanted to test the relationships between meaning-directed learning factors, and with earned credits and perceived competence (hypothesis 1a and 1b), as well as the relationships between the two types of outcomes as hypothesised in the main and reversed path model. First, Spearman's rank correlations between the independent and dependent variables were calculated. Because correlations, or multiple regression analysis, are not informative about the causality between variables, linear

structural analysis (Lisrel 8.52) was used in order to obtain a more complete picture of the causal relationships between the independent and dependent variables in terms of direct, indirect and total effects. The covariance matrix was used as input for testing two linear structural models. In answering the first research question, in both models, the meaning-directed learning factors are treated as independent or mediating variables. In testing hypothesis 2a in the *main* model, perceived competence also is a mediating variable which contributes to the explanation of earned credits. In the *reversed path* model (hypothesis 2b), earned credits is treated as a mediating variable, which contributes to the explanation of perceived competence as the more distant or final outcome. The goodness of fit statistics that were used are χ^2 (with $p > 0.05$ indicating a good fit), the Root Mean Square Error of Approximation (cut-off value < 0.05), the Standardised Root Mean Square Residual (cut-off value < 0.10), the Non-normed Fit Index (cut-off value > 0.95) and the Goodness of Fit Index (cut-off value > 0.95). Along with the 'goodness of fit' statistics, the standardised residuals were inspected (values < 3 standard deviations from zero) (Jöreskog and Sörbom 1989; Tabachnik and Fidell 2007). The χ^2 difference test was used to test the difference between the *reversed path* model and the *main* model (Kline 2005). The structural relationships between the latent variables are presented. Only the significant direct effects ($p < .05$) are presented.

Results

Correlations

First, the correlations between the independent variables and the dependent variables were computed (Table 3).

The table shows that self-regulation, intrinsic value and deep approach to learning are stronger related to perceived competence than to earned credits ($r = 0.29$, 0.35, 0.26 vs. $r = 0.16$, 0.16, 0.04). Perceived competence and earned credits are equally related to procrastination ($r = -0.29$ and $r = -0.30$). That is, students who have the tendency to postpone study activities earn fewer credits and report lower levels of perceived competence. Also, earned credits and perceived competence are significantly related ($r = 0.19$).

Causal relationships: the main model

The initial main model was adjusted in two respects. The paths from procrastination to deep approach to learning and from procrastination to perceived competence were removed. The tested final main model shows a satisfactory fit ($\chi^2 = 1.31$,

Table 3. Spearman's rank correlations.

	Competence	Earned credits
Self-regulation	0.28**	0.16**
Intrinsic value	0.35**	0.16**
Procrastination	−0.29**	−0.29**
Deep approach to learning	0.26**	0.03
Competence	1.0	0.18**

**$p < .01$, 2-tailed

df = 4, $p = 0.86$; Root Mean Square Error of Approximation (RMSEA) = 0.00, 90% confidence interval 0.0–0.029; Standardized Root Mean Square Residual (SRMR) = 0.0066; Non-normed Fit Index (NNFI) = 1.01; Goodness of Fit Index (GFI) = 1.00). The standardised residuals are between −0.73 and 0.31. The path analysis resulted in a number of significant direct effects (Figure 2).

The figure shows that students with high levels of self-regulation will have a lower level of procrastination (negative direct effect = −0.51), and higher levels of intrinsic value (direct effect = 0.23), deep approach to learning (direct effect = 0.27) and perceived competence (direct effect = 0.19). The indirect effects are calculated as the product of direct effects. For example, the indirect effect of self-regulation on perceived competence is the sum of the products of the coefficients (a) self-regulation → deep approach to learning → perceived competence ($0.27 \times 0.12 = 0.034$), (b) self-regulation → intrinsic value → perceived competence ($0.23 \times 0.29 = 0.066$) and (c) self-regulation → intrinsic value → deep approach to learning → perceived competence ($0.23 \times 0.24 \times 0.12 = 0.007$). Thus, the aggregate indirect effect of self-regulation on perceived competence is $0.034 + 0.066 + 0.007 = 0.11$. In other words, intrinsic value and deep approach to learning act as mediators of the relationship between self-regulation and perceived competence. The sum of this indirect effect (=0.11) and the direct effect (=0.19) is the total effect of self-regulation on perceived competence (=0.30; Table 4).

The total effects in the table show self-regulation as well as intrinsic value to have more influence on competence than deep approach to learning, whereas procrastination is not important at all.

In the same fashion, Figure 2 and Table 4 show *direct* effects of procrastination (−0.28), deep approach to learning (−0.08) and perceived competence (0.13) on earned credits. By mediation of one or more of these variables, self-regulation and intrinsic value have *indirect* effects on earned credits (values of 0.18 and 0.13). The

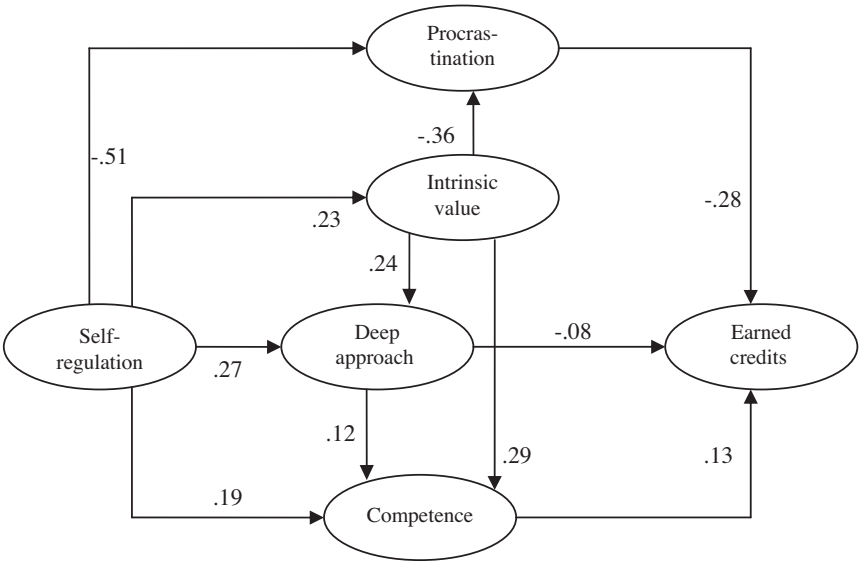

Figure 2. Standardised direct effects, main model.
Note: Only the significant direct effects ($p < .05$) are presented.

Table 4. Standardised total and indirect effects for the main model.

	Total effects					Indirect effects					Direct effects				
	Self-regulation	Procras-tination	Intrinsic value	Deep approach	Compe-tence	Self-regulation	Procras-tination	Intrinsic value	Deep approach	Compe-tence	Self-regulation	Procras-tination	Intrinsic value	Deep approach	Competence
Procrastination	−0.59	–	−0.36	–	–	−0.08	–	–	–	–	−0.51	–	−0.36	–	–
Intrinsic value	0.23	–	–	–	–	–	–	–	–	–	0.23	–	–	–	–
Deep approach	0.32	–	0.24	–	–	0.05	–	–	–	–	0.27	–	0.24	–	–
Competence	0.30	–	0.32	0.12	–	0.11	–	0.03	–	–	0.19	–	0.29	0.12	–
Earned credits	0.18	−0.28	0.13	−0.06	0.13	0.18	–	0.13	0.02	–	–	−0.28	–	−0.08	0.13

total effects in the table show that procrastination has the largest influence on earned credits (total effect = −0.28). That is, the tendency to postpone study activities directly leads to fewer credits. Self-regulation, intrinsic value and perceived competence have smaller total effects on earned credits (0.18, 0.13 and 0.13, respectively). Remarkable is the small direct negative effect of deep approach to learning on earned credits (−0.08), which is only compensated for a small part by the positive mediating effect of perceived competence (0.02), resulting in a total effect of −0.06. In sum, the total effects of self-regulation, intrinsic value and deep approach to learning are larger on perceived competence than earned credits, and procrastination only affects earned credits.

Alternative to the main model

We changed the direction of the path between earned credits and perceived competence: the *reversed path* model. This resulted in a model with an insignificant path between deep approach to learning and credits ($p > .05$), which was therefore removed. After the two changes, the tested reversed path model did not differ significantly from the main model ($\Delta\chi^2(1)^1 = 2.11$, $p = .14$). Also, the fit indices of this model are still acceptable ($\chi^2 = 3.41$, df = 5, $p = 0.6367$; RMSEA = 0.00, 90% confidence interval 0.0–0.039; SRMR = 0.012; NNFI = 1.00; GFI = 1.00). Therefore, the reversed path model hypothesising that earned credits explain perceived competence is not rejected. The direct effect of earned credits on perceived competence is 0.12 in this model (Figure 3; Table 5).

The figure shows that the direct effect of procrastination on earned credits is larger than that in the main model and, by mediation of earned credits, exerts a negative influence on perceived competence. Other direct effects in the reversed path model only slightly differed from or remained the same as the values in the main model.

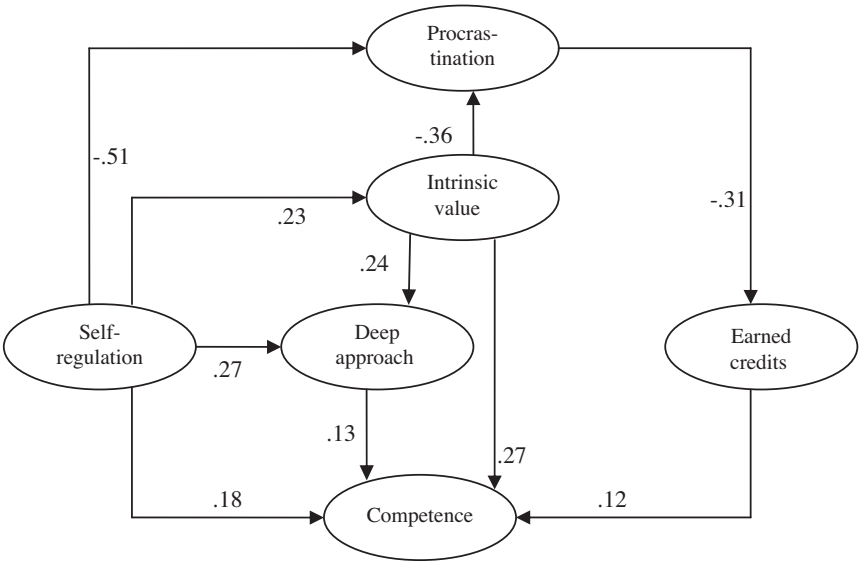

Figure 3. Standardised direct effects for the reversed path model.
Note: Only the significant effects ($p < .05$) are presented.

Table 5. Standardised total and indirect effects for the reverse path model.

	Total effects					Indirect effects					Direct effects				
	Self-regulation	Pro-crastination	Intrinsic value	Deep approach	Earned credits	Self-regulation	Procras-tination	Intrinsic value	Deep approach	Earned credits	Self-regulation	Procras-tination	Intrinsic value	Deep approach	Earned credits
Procrastination	−0.59	–	−0.36	–	–	−0.08	–	–	–	–	−0.51	–	−0.36	–	–
Intrinsic value	0.23	–	–	–	–	–	–	–	–	–	0.23	–	–	–	–
Deep approach	0.32	–	0.24	–	–	0.05	–	–	–	–	0.27	–	0.24	–	–
Earned credits	0.18	−0.31	0.11	–	–	0.18	–	0.11	–	–	–	−0.31	–	–	–
Competence	0.30	−0.04	0.31	0.13	0.12	0.12	−0.04	0.04	–	–	0.18	–	0.27	0.13	0.12

Conclusion and discussion

The first question in this paper was: 'Does the model presented in Figure 1 provide an adequate representation of the relations between the theoretical concepts?' Concerning hypothesis 1a, the accepted models show direct effects of self-regulation on deep approach to learning (Figures 2 and 3; Table 4), which is in line with our expectations (Bruinsma 2004; Entwistle and Peterson 2004; Pintrich and De Groot 1990; Ryan and Deci 2000; Vermunt 2005). The positive effect of intrinsic value on deep approach to learning is in agreement with prior research (e.g. Wolters and Pintrich 1998). Furthermore, self-regulation and intrinsic value affect procrastination. That is, students who affirm more meta-cognitive capacities and interest in their programme will show less inclination to postpone study activities (Schraw, Wadkins, and Olafson 2007). Apparently, in the chain of factors explaining earned credits and/or perceived competence, self-regulation and intrinsic value precede procrastination and deep approach to learning in both models. However, in contrast with Bruinsma (2004), procrastination does not have an effect on a student's intent to deploy a deep approach to learning. That is, the influence of this expectancy-component of motivation on deep approach, as hypothesised in Figure 1, is not confirmed by the two accepted models.

With regard to hypothesis 1b, meaning-directed learning affects earned credits and perceived competence, which is in line with previous research (Bruinsma 2004; Entwistle and Peterson 2004; Pintrich and De Groot 1990). In accordance with Bruinsma (2004), we find that a deep approach to learning negatively affects earned credits. This result contradicts Vermunt (2005), who found a positive relationship between a deep approach to learning and earned credits. We also find that procrastination is a mediator for the influence of self-regulation and intrinsic value on earned credits. Indeed, lower levels of procrastination lead to more credits (Bruinsma 2004). Moreover, self-regulation and intrinsic value directly affect perceived competence and have an indirect impact by mediation of a deep approach to learning (Entwistle and Peterson 2004; Pintrich and De Groot 1990; Vermunt 2005). Procrastination influences perceived competence neither directly nor indirectly.

The second question concerned the nature of the relationship between perceived competence and earned credits, and we distinguished two possible models. In the main model (hypothesis 2a), an effect of perceived competence on earned credits is confirmed (direct effect = 0.13). Students who feel (are) competent, will attain slightly more credits, although the small effect suggests that perceived competence certainly is not a necessary or sufficient condition for earning credits. The reversed path model (hypothesis 2b) showed a similar influence of earned credits on perceived competence (direct effect = 0.12). Apparently earned credits do not guarantee that students feel competent. Students, having fulfilled the requirement of the degree programme in terms of credits, will also report to feel competent, although this relationship is not very strong. The credits earned, based on what students have learned during the first year, only slightly reflect how competent they feel or are.

However, the correlation of 0.18 we found between perceived competence and earned credits is not exceptionally small. For example, Hattie (2009) reports various studies which found similar low relationships between self-measures and achievement ($r = 0.20$). The low relationships may be due to the many overlapping or intertwining elements of which self-concepts consist, like the many fibres that make a

rope in Hattie's rope-analogy. Perceived competence is just one of these elements. Likewise, standardised path coefficients of 0.08 between the independent or mediating variables on perceived competence or earned credits, indicating small influences of the mediating and independent variables on achievement, are frequently reported in other studies (Bruinsma 2004; Valentine, DuBois, and Cooper 2004). The reason for the stronger paths from deep learning to perceived competence, compared to earned credits, may be that these variables are based on self-perceptions. It should also be noted that self-beliefs in this study are not domain-specific. Self-estimates of ability in a specific domain, for example mathematics, will show a much stronger relationship with achievements (Baartman and Ruijs 2011).

Apart from these considerations, there are other explanations for the rather low perceived competence-earned credits relationship on the levels of students, system and teachers. First, *students* sense and have to cope with different incentive systems and goals that are operating in higher education. The attainment of qualitative goals, advocated by CBE as expressed in perceived competence, may be at the cost of the attainment of competing quantitative goals, such as earning credits (Covington 2000). The findings in this study do not contradict this explanation. Students may know how to become competent (by deep approach to learning), and use their self-regulatory capacities to that purpose (in deploying deep learning, not delaying study activities), which results in earned credits. However, at the same time, they may experience difficulties with the competing goals of the programme ('to be competent' vs. 'to earn credits, no matter if I understand everything'), and competing activities outside the programme, leading to procrastination with regard to study activities and subsequent fewer credits. The observed relatively low levels of self-regulation and procrastination, although similar to the ones found in other studies (e.g. Bruinsma and Jansen 2007), confirm that there is still a lot to be gained in this regard.

Second, higher education *institutions* experience the discrepancy between two types of goals as they are confronted with the call from society to enable students to acquire competence in a cost-efficient way. As a consequence, institutions may feel invited to adhere to quick successes (rewards in terms of credits) and to drift away from consistency between CBE, assessment and the qualitative goal of competence. This ambiguity may be reflected in students, when they develop an attitude of indifference towards either the goal of acquiring competence, or earning credits as a prerequisite for their diploma or even both.

Third, *teachers* in CBE are coaches of their students, who have to work independently or in groups. This coaching role may be at odds with their specific academic or professional backgrounds, and this explains criticisms that the knowledge component in CBE-based higher vocational education receives too little attention (cf. Mulder, Weigel, and Collins 2007). Teachers may prefer to give up the coaching role and reduce competence to isolated knowledge or skills of their discipline, which is reflected in the type of examinations. This restricted approach to assessment may be an invitation to students to stick to rote learning of factual knowledge and demonstration of skills, and is at odds with the emphasis on competence in the concept of CBE. In sum, on all levels, the participants of higher education may not know how to handle the different measures for study outcomes. It seems that the attained system of assessment differs from the implemented as well as the intended system of assessment in CBE (cf. Van den Akker 2003).

Further research is needed to determine the interplay between perceived competence and earned credits. The confirmation of the main model as well as the reversed path model strongly suggests the existence of a reciprocal-effects model (Marsh and Yeung 1997). The cross-sectional design of the present study was not appropriate for analysing this reciprocal relationship. Marsh and Yeung (1997) proposed an approach with at least at two moments measures of competence (general and domain-specific) and achievement, enabling to determine developmental change over time. Indeed, using a longitudinal design, Phan (2010) showed that competence and earned credits are related over time. Furthermore, the conceptual model of this study could be extended with background characteristics, social factors and study skills (cf. Robbins et al. 2004). Because self-regulation only partially explains study success, external regulation factors on the level of course, organisation, or grant system could be included in the model (Jansen 2004; Van den Berg and Hofman 2005). Also, students' self-assessment skills are sometimes reported to be limited, resulting in overestimation of their perceived competence (Baartman and Ruijs 2011; Lew, Alwis and Schmidt 2009). It would have been interesting to use a more differentiated measurement of competence, based on the forms of assessments that are currently used in the practise of CBE (Dochy, Segers, and Sluijsmans 1999).

What could be the practical implications of the results of this study? Students are agents of the outcomes of their learning process. Although influences may seem fairly modest, perceived competence seems relevant for achievement, as achievement seems relevant for perceived competence. These results support that CBE policy addresses both types of goals (cf. Valentine, DuBois, and Cooper 2004). Making students aware of their self-regulation and motivational beliefs and behaviour, may help them to become better motivated, for example by setting the right goals, and use a deep approach to learning. Self-regulation and study skills (Robbins et al. 2004; Schunk and Ertmer 2000), a deep approach to learning (Entwistle and Peterson 2004) and motivation (Eccles and Wigfield 2002; Ryan and Deci 2000) are important factors which can be influenced. Being aware that a deep approach to learning does not necessarily lead to more credits, and that perceived competence is not the same as credits awarded by current assessment systems, may help students to become more efficient learners. For all participants in higher education and researches it remains important to be aware that different learning objectives may evoke different study behaviours in students. Therefore, the transparency of learning objectives and the communication of expected learning behaviour to students is indispensable. The challenge for higher education is to influence the learning process in support of the attainment of different learning objectives.

Note

1. The reversal path does not change the degrees of freedom, therefore the chi-square difference test with df = 1 is used.

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