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Student perceptions of assessment and student self-efficacy in competence-based education

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The purpose of this study was to provide insight into the interplay between student perceptions of competence-based assessment and student self-efficacy, and how this influences student learning outcomes. Results reveal that student perceptions of the form authenticity aspect and the quality feedback aspect of assessment do predict student self-efficacy, confirming the role of mastery experiences and social persuasions in enhancing student self-efficacy as stated by social cognitive theory. Findings do not confirm mastery experiences as being a stronger source of self-efficacy information than social persuasions. Study results confirm the predictive role of students' self-efficacy on their competence outcomes. Mediation analysis results indicate that student's perceptions of assessment have an indirect effect on student's competence evaluation outcomes through student's self-efficacy. Study findings highlight which assessment characteristics, positively influencing students' learning, contribute to the effectiveness of competence-based education. Limitations of the study and directions for future research are indicated.

Keywords: self-efficacy; assessment characteristics; perceptions of assessment; competence-based assessment; student perceptions

Introduction

As a response to a society that has a growing need for creative and flexible professionals, higher educational institutes are modifying their educational programmes to become so-called new learning environments, in which students are confronted with complex real-life problems and situations for developing relevant competences (De Corte et al. 2003). Though competent behaviour largely depends on acquiring relevant knowledge, skills and competences, researchers in educational settings are increasingly also drawing attention to the role of student self-efficacy and student perceptions during learning (Baartman and Ruijs 2011; Dochy et al. 2005; Schunk 2003).

In particular, self-efficacy, as a key construct of social cognitive theory, appears to be a significant variable because it affects student learning and performance (see

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e.g. Pajares 2006). Educational programmes based on the main sources of self-efficacy, namely enactive mastery experiences, vicarious experiences and social persuasions, have the potency of enhancing student self-efficacy (van Dinther, Dochy, and Segers 2011). According to social cognitive theory (Bandura 1997), enactive mastery experiences are authentic successes in dealing with particular situations, vicarious experiences are observational experiences provided by social models and social persuasions refer to encouragement and evaluative feedback communicated by important others.

Competence-based education and other new learning environments, often use assessment as a tool for learning (Black and Wiliam 1998; Gielen, Dochy, and Dierick 2003). This is in accordance with a line of research which points to the influential role of assessment as perceived by students. In particular, student perceptions of the specific assessment characteristics: authenticity of assessment (Gulikers 2006; Janssens, Boes, and Wante 2002; Sambell, McDowell, and Brown 1997) and feedback (Gibbs and Simpson 2004a; Higgins and Hartley 2002; Segers, Gijbels, and Thurlings 2008), appear to play a positive role in student learning. Considering the connection that can be made between these assessment characteristics and the above-mentioned sources of self-efficacy, respectively, mastery experiences and verbal persuasions, we argue that student perceptions of these assessment characteristics can positively influence student self-efficacy.

The context for this study is a competence-based teacher educational programme in which formative competence assessment is used, preceding the first-year final competence evaluation. Formative competence assessment, as a part of the instructional process, enables students to improve their competences, by providing them with feedback on their competence development. The focus of this article is the impact of student perceptions of formative assessment on student development of self-efficacy, which in its turn has an impact on the outcome of the final competence evaluation. Student self-efficacy can be considered to play a key role, both intermediate and direct, in predicting competence evaluation outcomes. The purpose of this study is to provide more insight into the interplay between student perceptions of competence-based assessment, student self-efficacy and how this influences student learning outcomes. The findings of our study can highlight which processes are essential in establishing the effectiveness of the competence-based approach within higher education.

Self-efficacy and perceptions of assessment

As a key construct of social cognitive theory, self-efficacy appears to be a significant variable because it affects student motivation and learning (Bandura 1997; Schunk and Pajares 2001). Self-efficacy refers to “*beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments*” (Bandura 1997, 3). According to social cognitive theory, there are four main sources of information that are responsible for the development of students’ self-efficacy: enactive mastery experiences, vicarious (observational) experiences, social persuasions and physiological and psychological states. In this study, we focus on mastery experiences and social persuasions because these sources can be connected with the main characteristics of competence-based assessment.

Mastery experiences, in other words authentic successes in performing tasks within demanding situations, are stated as the most powerful source of self-efficacy

and research shows that mastery experiences are significant predictors of creating a strong sense of self-efficacy (Bandura 1997; Britner and Pajares 2006). Research on factors affecting student self-efficacy in higher education (van Dinther, Dochy, and Segers 2011; Lancaster and Bain 2007; Palmer 2006; Papastergiou 2010) confirms the role of mastery experiences within education and stresses the relevance of providing students with practice-oriented learning experiences as a necessary condition for acquiring mastery experiences.

Feedback or information about the outcome of an action is considered a second (persuasive) source for creating self-efficacy information. Feedback, encouragement and support, especially from important others, such as parents and teachers, enhance student self-efficacy (Bandura 1997, Bong and Skaalvik 2003; van Dinther, Dochy, and Segers 2011; Schunk and Pajares 2001).

Both sources of self-efficacy, mastery experiences and feedback, are clearly related to assessment practices. In this respect, during the last decades, many scholars have been arguing for the alignment of assessment with how learning and instruction is taking place. They have put forward the importance of student perceptions of two characteristics of assessment, authenticity (Gulikers 2006; Janssens, Boes, and Wante 2002; Sambell, McDowell, and Brown 1997) and feedback (Gibbs and Simpson 2004a; Higgins and Hartley 2002; Segers, Gijbels, and Thurlings 2008). Authenticity refers to the relatedness of assessment tasks to real-life situations and meaningful problems as part of the professional practice. Student perceptions of authenticity of assessment refer to how practice-oriented assessment is perceived by students (Gulikers 2006). Since practice-oriented learning experiences can be seen as a necessary condition for gaining mastery experiences (van Dinther, Dochy, and Segers 2011; Palmer 2006), the assessment characteristic authenticity can be connected with this source of creating self-efficacy. Perceptions of feedback refer to how students perceive information about the outcome of assessment (Gibbs and Simpson 2004a). Because feedback from others such as teachers influences students' self-efficacy, this assessment characteristic can easily be connected with social persuasions as another source of creating self-efficacy.

Based on the above we test the following hypothesis in this study:

Hypothesis 1. Student perceptions of the authenticity of competence-based assessment and feedback given have a positive effect on student self-efficacy.

Bandura (1997) states that mastery experiences are the most powerful source of self-efficacy information, research on factors affecting student self-efficacy in higher education confirms this assertion (van Dinther, Dochy, and Segers 2011; Lancaster and Bain 2007; Palmer 2006; Papastergiou 2010). Following Bandura (1997), we presume that authenticity of assessment has a stronger influence on student self-efficacy than feedback given. We test this with the following hypothesis of this study:

Hypothesis 2. Student perceptions of the authenticity of competence-based assessment have a more powerful effect on student self-efficacy than perceptions of feedback given.

Self-efficacy and competence

Developing a social cognitive theory, Bandura (1986, 1997) assumed that a strong self-efficacy belief affects the choices people make, their ways of acting, the effort

they spend, their perseverance and elasticity (Bandura 1997). Research findings support these assumptions among several domains of human functioning such as health, sports and work-related performance (Luszczynska and Schwarzer 2005; Schwarzer et al. 2010; Stajkovic and Luthans 1998). Concerning the educational domain the relation between self-efficacy and achievement has been investigated at various levels of education (e.g. primary, secondary and tertiary), several areas (reading, writing, mathematics and computing science) and different ability levels (average, talented and below average). These studies (Bouffard-Bouchard 1990; Carmichael and Taylor 2005; Lane, Lane, and Kyprianou 2004; Pajares 1996, 2006; Pajares and Miller 1994; Relich, Debus, and Walker 1986; Schunk 2003) show, among other things, direct effects of student self-efficacy on achievements with respect to several grades and ability levels. Within the context of this study, students are examined within a final competence evaluation that takes place at the end of the first-year programme. Following social cognitive theory and given the strong empirical results on the general role of self-efficacy in competence development, we test the following hypothesis in this study:

Hypothesis 3. Student self-efficacy positively predicts student competence evaluation outcomes.

In the foregoing, we argued the following: student perceptions of the authenticity of assessment and feedback given play a positive role in student learning and learning outcome, student perceptions of the authenticity of and feedback given have a positive effect on student self-efficacy, and student's self-efficacy positively predicts student competence evaluation outcomes. Considering the substantial role self-efficacy plays in student learning and achievement (Bandura 1997, 2006; Schunk and Pajares 2001), we assume self-efficacy plays an intermediate role between student perceptions of a formative competence-based assessment and their competence outcomes as a result of the final evaluation. We test this with the following hypothesis:

Hypothesis 4. Student perceptions of assessment have an indirect effect on student competence evaluation outcomes mediated through student self-efficacy.

In Figure 1, we summarise the research model for this study.

Method

Participants and setting

The data in this study were collected from a sample of 138 first-year student teachers, enrolled in a Dutch four-year bachelor programme for elementary teacher education (response rate 42%). The group of participants was homogenous in relation to age (mean age 18,8), prior educational level, teaching experience and gender (95% were female students and 5% male, which is typical for elementary teacher education). The context of this study is a competence-based teacher educational curriculum in which a teacher competence profile is used that serves as a standard required to be achieved at the end of the educational process. Next to this, formative assessment is used to monitor student competence development. At the end of a first-year module including formative assessment but preceding the first-year evaluation, these students were asked by their teacher-coach to fill in a perceptions of authenticity

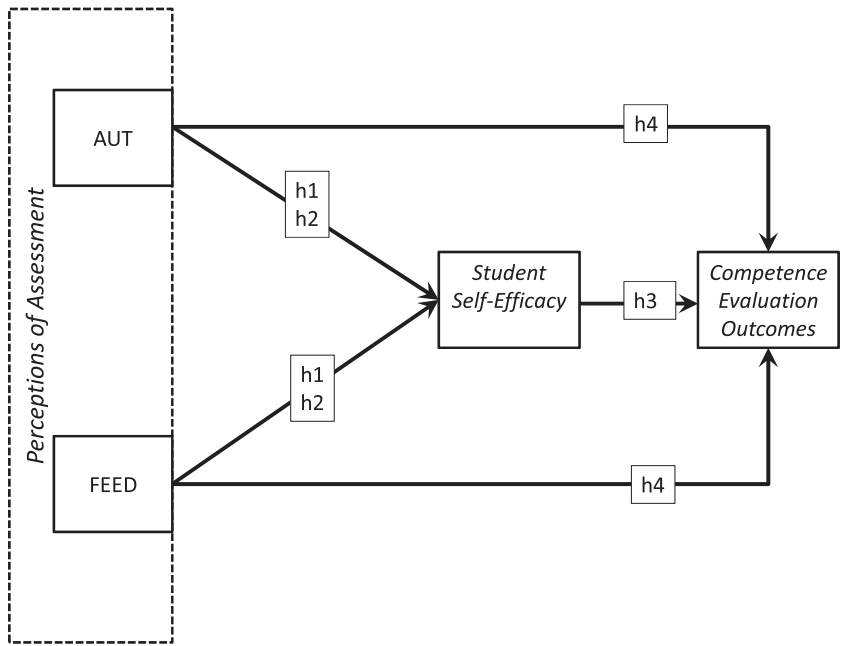


Figure 1. Research model.
Notes: *h* = hypothesis; AUT = authenticity; FEED = feedback.

questionnaire (Gulikers, Bastiaens, and Kirschner 2004, 2006), a perceptions of feedback questionnaire (Gibbs and Simpson 2004b), and a student teacher efficacy questionnaire. Afterwards, at the very end of the first-year programme, the results of the first-year final competence evaluation were collected.

Measures

Student competence evaluations

The results of the final first-year evaluation were used to evaluate student competences. To reach the optimal level of inter-rater agreement, each student was evaluated by two skilled assessors within a standardised portfolio assessment procedure. Students are evaluated on competences that are developed by the Dutch Association for the Professional Quality of Teachers (2006). This Dutch association (2006) developed and validated a framework for elementary teacher competences in close collaboration with a large representation of the professional group of teachers in the field (Dietze, Jansma, and Riezebosch 2000). The resulting framework, serving as a teaching standard, resembles highly the teacher competencies from other international studies in the field of teacher education (see e.g. Fives and Buehl 2008; Gonzales and Wagenaar 2005; Kovács-Cerović 2006; Pantic and Wubbels 2010; Storey 2006; Tigelaar et al. 2004; Zgaga 2006). For a starting student teacher, this framework consists of six elementary aspects of teacher competence (Figure 2). As a result of this final first-year evaluation, students received, within this specific learning environment, a pass score (coded as: 1) or fail score (coded as: 0) on each of six

competences. Hence, the outcome variable of this study is a categorical variable based on a natural underlying binary phenomenon (O’Connell and Amrico 2010).

Student teacher self-efficacy

To measure self-efficacy in direct correspondence with the competence evaluations, a teacher efficacy questionnaire was constructed, following Bandura’s standardised guidelines for self-efficacy measures (2006), such that each of the six subscales reflects one of the six evaluated competences (van Dinther et al. 2013). This comes down to 22 100-point scale items in total, with 3 to 4 items in each subscale (Cronbach α ranging from 0.74 to 0.89). Factor analysis results delivered evidence for an underlying multi-dimensional structure of the questionnaire, reflecting the teacher competence framework (van Dinther et al. 2013). Since student teacher self-efficacy is a multi-factor construct (Bandura 1997), the hypotheses will be tested for six self-efficacy variables reflecting six aspects of teacher competence.

Student perceptions of authenticity

For the purpose of this study, the two subscales about authenticity of the *Task* (5 items, Cronbach α =0.79) and *Form* (4 items, Cronbach α =0.71) of the authenticity perception questionnaire (APQ: Gulikers, Bastiaens, and Kirschner 2004, 2006) were used to measure the extent to which the assessment is perceived by students as reflecting real-life situations and meaningful problems. Student perceptions of authenticity were measured using a 5-point Likert scale (coding: 1 = low/strongly disagree, 5 = high/strongly agree).

Student perceptions of feedback

For the purpose of this study, the three subscales about feedback Quantity (6 items, Cronbach α =0.87), Quality (6 items, Cronbach α =0.77), and feedback Use (6 items, Cronbach α =0.74) of the Assessment Experience Questionnaire (AEQ: Gibbs and Simpson 2004b) were used to measure the extent to which assessment is perceived by students as meeting the conditions under which assessment supports student learning. Student perceptions of feedback were measured using a 5-point Likert scale (coding: 1 = low/strongly disagree, 5 = high/strongly agree).

Interpersonal Competence	Pedagogical Competence	Subject knowledge and metho- logical competence	Organizational Competence	Competence for collaboration with colleagues	Competence for reflection and development
INT	PED	SKM	ORG	COL	REF

Figure 2. Teacher competence with inside the six competence aspects.

Thus, in total, we consider a set of six competence evaluation outcomes, a set of six corresponding self-efficacy subscales and a set of five perceptions of assessment subscales (two for authenticity and three for feedback).

Data analysis

All statistical analyses were performed in the open-source statistical software R (R Core Team 2013) and used maximum likelihood for model estimation. We used multiple regression to test whether perceptions of assessment predict student teacher self-efficacy (Hypothesis 1). More specifically we tested if each of the perceptions of assessment variables (i.e. 5 predictors) predicted the 6 self-efficacy variables. Hypothesis 2 involves a comparison between the contribution of two sets of predictors: a predictor block consisting of the two authenticity variables and a predictor block of the three feedback variables. The effect of a predictor block can be summarised in a so-called sheaf coefficient or block effect which is a linear composite based upon the regression coefficients of the predictors in that block (see e.g. Heise 1972; Whitt 1986). Because there is no standard asymptotic method available to test such block effect, we used bootstrap, a resampling technique (see e.g. Efron and Tibshirani 1993), to test Hypothesis 2. Bias-corrected bootstrap confidence intervals were constructed around the difference between the two block effects ($\Delta = \beta[\text{Authenticity}] - \beta[\text{Feedback}]$). The null hypothesis is that the two blocks have an equal effect on self-efficacy, and would be rejected when a zero value is outside the corresponding confidence interval for their difference.

We used a logistic regression to test if student teacher self-efficacy predicts the competence evaluation outcome (Hypothesis 3). More specifically we tested if the 6 self-efficacy variables predicted their corresponding 6 competence aspects. For comparability with linear regression and ease of interpretation we opted to report a generalised R^2 statistic (Zheng and Agresti 2000). Additionally, we also accounted for the assessment predictors by adding assessment as an extra single predictor and as predictor in combination with self-efficacy.

To test Hypothesis 4 we used mediation analysis involving the computation of indirect effects through a combination of linear regression coefficients (perceptions of assessment \rightarrow self-efficacy) and logistic regression coefficients ([perceptions of assessment +] self-efficacy \rightarrow competence evaluation outcome). Since there is no standard method available for this type of computation, we used as recommended the bootstrap technique to conduct a mediation analysis (see e.g. Kelley and Maxwell 2010; Shrout and Bolger 2002). The latter logistic coefficients were first standardised according to the underlying response variable (see e.g. MacKinnon and Dwyer 1993), after which the resulting standardised indirect effects were tested using bias-corrected bootstrap confidence intervals. For each competence aspect, the whole set of standardised mediation analysis results is summarised in a figure (Figures 3–8).

Results

Descriptives

In Table 1, the descriptives and correlation matrix concerning the assessment characteristics authenticity and feedback and the student teacher self-efficacy aspects are

depicted. Inspection of the means and standard deviations of the assessment characteristics (columns 1 and 3, rows 1–5) shows that students perceive the assessment as rather authentic i.e. professionally relevant, the same counts for students perception of feedback given. Students teacher self-efficacy (columns 1 and 2, rows 6–11) demonstrates a range from 75.62 to 82.03, indicating that students feel quite efficacious on all self-efficacy aspects.

Scrutiny of correlations between the authenticity aspects *Task* and *Form* and the feedback aspects *Quantity*, *Quality* and *Use* (columns 1 to 5, rows 2–5) reveals that these predictor variables do not correlate too highly. Finally, the correlations between the student teacher self-efficacy aspects (columns 7–11, rows 6–11) show high but not too high correlations, which is not surprisingly given the underlying factor structure.

Perceptions of assessment and self-efficacy

Referencing Hypothesis 1, the results of multiple regression reveal that both the authenticity block as the feedback block predict each of the six self-efficacy variables, indicating that this hypothesis can be confirmed (see R^2 Table 2). Student perceptions of the authenticity of competence-based assessment and feedback given do predict student self-efficacy, resulting in a percentage of explained variance ranging from 18% (SE-INT) to 43% (SE-REF).

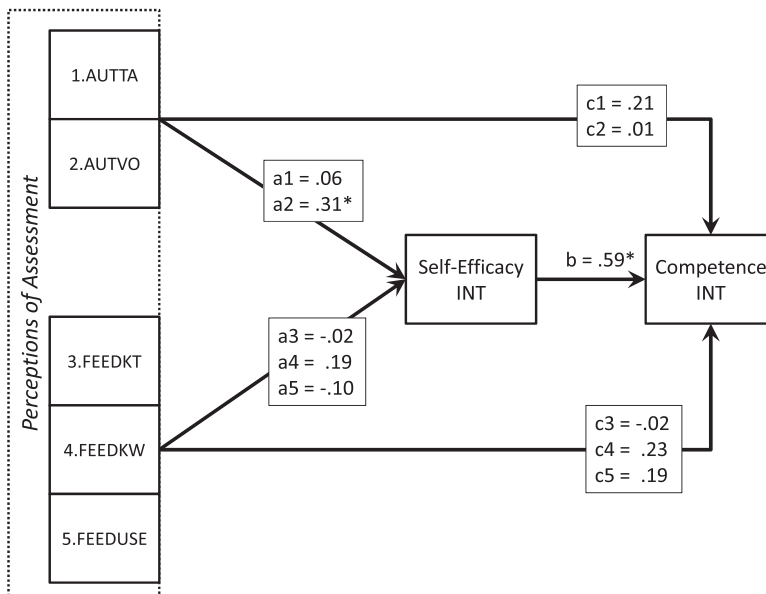


Figure 3. Standardised results of the mediation analyses: Perceptions of assessment through self-efficacy to the competence evaluation outcome INT.

Notes: The correlations between the perceptions of assessment measures are omitted for reasons of clarity. Indirect effects from perceptions of assessment over self-efficacy to competence evaluation outcome consist of the $a \times b$ product. INT = Interpersonal Competence with corresponding self-efficacy variable.

To take a closer look at the single predictors within the authenticity and feedback blocks, we depicted the effects of authenticity of the Task (a1) and Form (a2), feedback Quantity (a3), feedback Quality (a4) and feedback Use (a5), on each of the self-efficacy variables (see Figures 3–8, left side). Inspection of the resulting regression coefficients a1–a5 reveals that, with a few exceptions, the authenticity aspect Form (a2-INT = 0.31* ; a2-PED = 0.29* ; a2-SKM = 0.46* ; a2-ORG = 0.38* ; a2-COL = 0.23* ; a2-REF = 0.43*) and the feedback aspect Quality (a4-PED = 0.31* ; a4-SKM = 0.25* ; a4-COL = 0.35* ; a4-REF = 0.41*) are the most prominent predictors.

Hypothesis 2 states that authenticity is a stronger predictor of self-efficacy than feedback. The test for the difference in block effects (Difference Δ , Table 2) did not support a significant difference between the effects of the authenticity block and the feedback block. Although there was not enough evidence to statistically support this hypothesis, inspection of the Δ differences across the self-efficacy variables revealed that for three of the six self-efficacy aspects (SKM: difference Δ 0.21; ORG: difference Δ 0.18 and INT: difference Δ 0.16), authenticity tended to have a stronger effect than feedback. In first-year students perception these three self-efficacy aspects possibly demonstrate the strongest resemblance with the professional teaching practice. On the other three self-efficacy aspects (PED, COL and REF), the block effects of the two perceptions were rather similar.

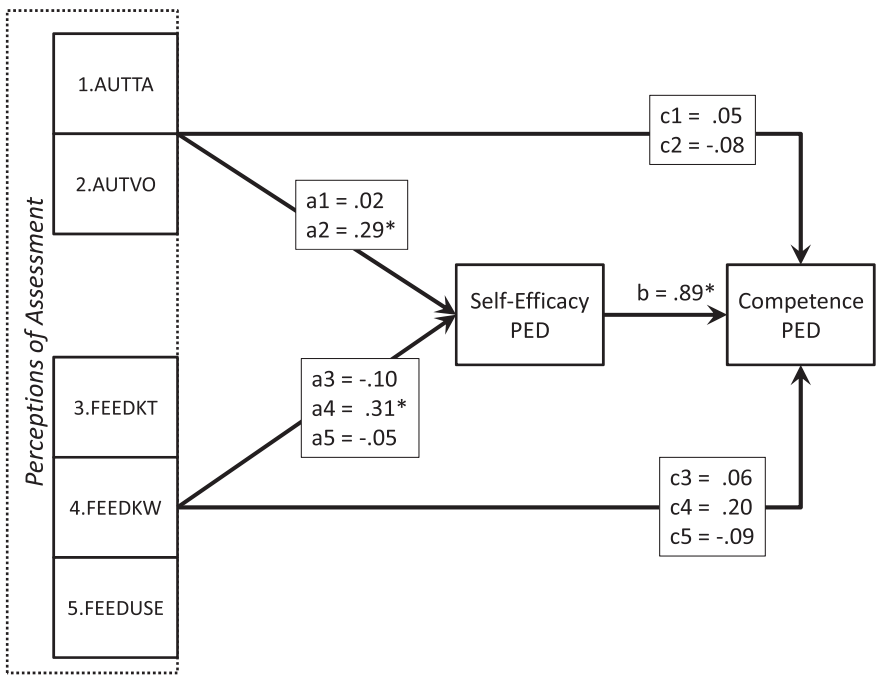


Figure 4. Standardised results of the mediation analyses: Perceptions of assessment through self-efficacy to the competence evaluation outcome PED.

Notes: The correlations between the perceptions of assessment measures are omitted for reasons of clarity. Indirect effects from perceptions of assessment over self-efficacy to competence evaluation outcome consist of the $a \times b$ product. PED = Pedagogical competence with corresponding self-efficacy variable.

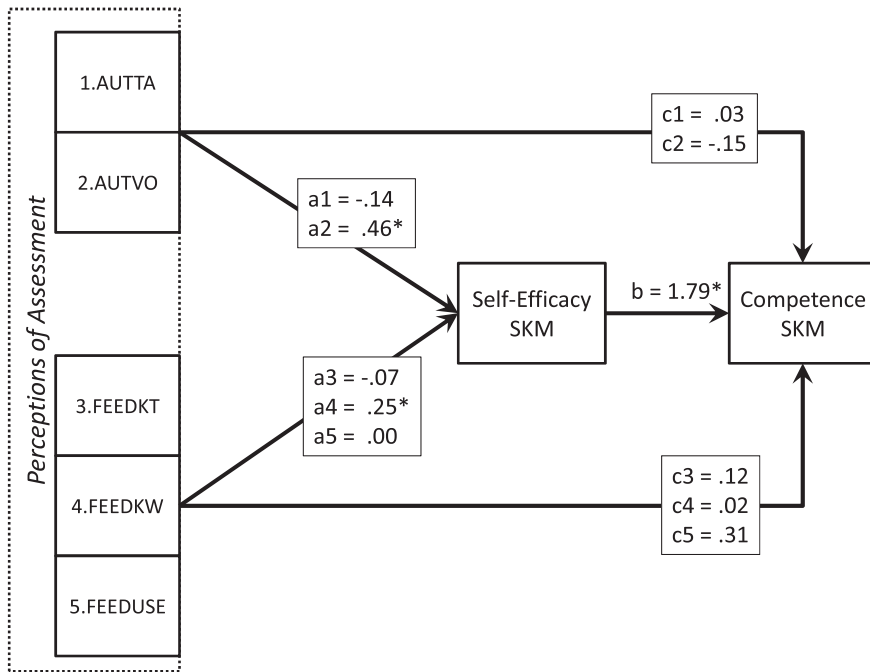


Figure 5. Standardised results of the mediation analyses: Perceptions of assessment through self-efficacy to the competence evaluation outcome SKM.

Notes: The correlations between the perceptions of assessment measures are omitted for reasons of clarity. Indirect effects from perceptions of assessment over self-efficacy to competence evaluation outcome consist of the $a \times b$ product. SKM = Subject knowledge and methodological competence with corresponding self-efficacy variable.

Self-efficacy and competence

The results of the logistic regression, testing if student teacher self-efficacy predicts the competence evaluation outcome, reveal the following generalised R^2 (see generalised R^2 , row: only SE, Table 3): SE-INT on Competence-INT: 0.11; SE-PED on Competence-PED: 0.20; SE-SKM on Competence-SKM: 0.56; SE-ORG on Competence-ORG: 0.18; SE-COL on Competence = COL: 0.18; SE-REF on Competence-REF: 0.28, these results are all significant.

Even after accounting for the assessment predictors (i.e. adding assessment as extra predictors; row PA and SE, Table 3), student teacher self-efficacy still has a unique significant contribution to the prediction of the competence evaluation outcome, see the corresponding b -values in Figures 3–8 (right side), respectively: 0.59, 0.89, 1.79, 1.12, 0.94 and 0.96; all significant. These results demonstrate that Hypothesis 3 can be confirmed. Student teacher self-efficacy succeeds in making a reasonable prediction of student competence evaluation outcomes on all of the six competence aspects.

For Hypothesis 4, we used mediation analysis to test if student's perceptions of assessment have an indirect effect on student's competence evaluation outcomes through student self-efficacy. The c -values ($c1$ – $c5$, Figures 3–8) reveal a general

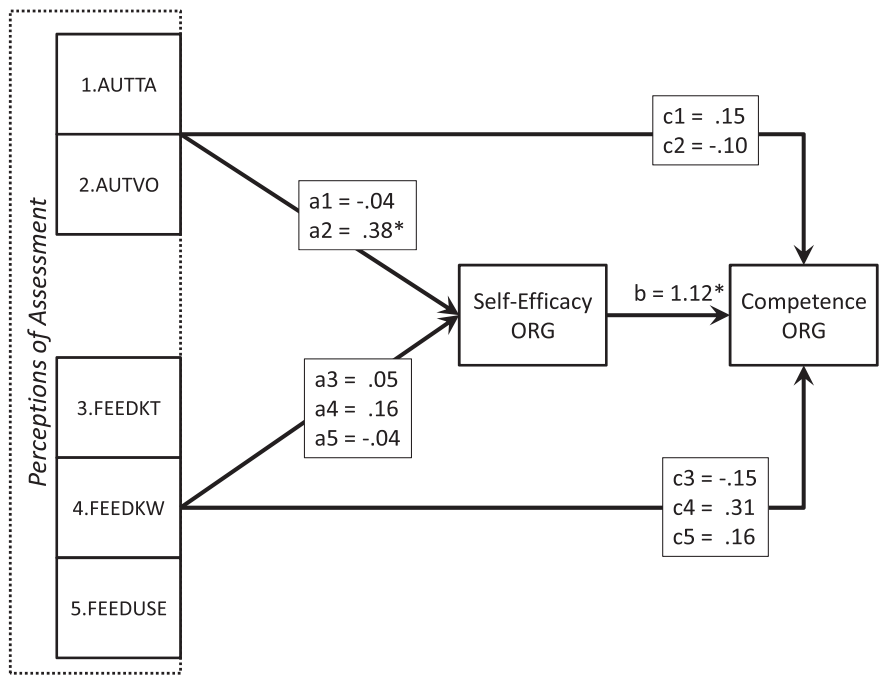


Figure 6. Standardised results of the mediation analyses: Perceptions of assessment through self-efficacy to the competence evaluation outcome ORG.
Notes: The correlations between the perceptions of assessment measures are omitted for reasons of clarity. Indirect effects from perceptions of assessment over self-efficacy to competence evaluation outcome consist of the $a \times b$ product. ORG = Organisational competence with corresponding self-efficacy variable.

absence of direct effects of perceptions of assessment on competence evaluation outcomes.

These results in combination with bias-corrected bootstrap confidence intervals for indirect effects of perceptions of assessment on competence evaluation outcomes in Table 4, provide clear support for Hypothesis 4.

A closer look at the indirect effects of the assessment aspects (see Table 4) reveal that the authenticity aspect form [$\beta = 0.18$, 95%CIs (0.02, 0.39); $\beta = 0.26$, 95%CIs (0.10, 0.49); $\beta = 0.82$, 95%CIs (0.49, 1.19); $\beta = 0.42$, 95%CIs (0.19, 0.70); $\beta = 0.22$, 95%CIs (0.05, 0.43); $\beta = 0.42$, 95%CIs (0.24, 0.62)] and the feedback aspect quality [$\beta = 0.28$, 95%CIs (0.08, 0.55); $\beta = 0.45$, 95%CIs (0.10, 0.83); $\beta = 0.33$, 95%CIs (0.14, 0.64); $\beta = 0.39$, 95%CIs (0.22, 0.60)] with a few exceptions, exhibit through self-efficacy the strongest indirect effects compared with the other assessment aspects.

Comparison of the individual and joint contributions of perceptions of assessment and self-efficacy to competence evaluation outcomes (R^2 in Table 3, row Only SE) reveals that self-efficacy is often the strongest predictor. The differences between Perceptions of Assessment and Self-efficacy (see: Table 3, third row: PA and SE) and Only Self-efficacy (see Table 3, second row: Only SE) are, respectively: 0.05, 0.02, 0.02, 0.06, 0.14 and 0.03. These results demonstrate that when

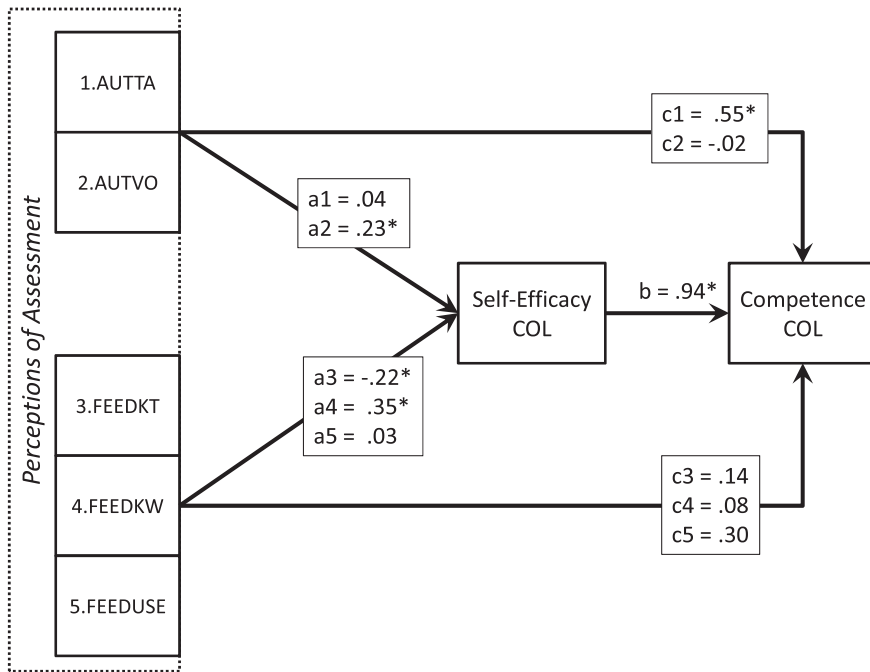


Figure 7. Standardised results of the mediation analyses: Perceptions of assessment through self-efficacy to the competence evaluation outcome COL.

Notes: The correlations between the perceptions of assessment measures are omitted for reasons of clarity. Indirect effects from perceptions of assessment over self-efficacy to competence evaluation outcome consist of the $a \times b$ product. COL = Competence for collaboration with colleagues with corresponding self-efficacy variable.

self-efficacy is already included, perceptions of assessment often make only a slight extra contribution to the prediction of competence evaluation outcomes.

Discussion

The purpose of this study was to provide more insight into the interplay between student perceptions of competence-based assessment and student self-efficacy, and how this influences student learning outcomes.

A first result includes that student perceptions of (formative) assessment do predict student self-efficacy, and particularly student perceptions of the form authenticity aspect and the quality feedback aspect showed to be the best predictors. The influence of this type of perceptions confirms the role that the two main sources of self-efficacy information play, as stated by social cognitive theory. The results indicate that formative competence assessment, (1) requiring students to create a quality product or observable performance in a real-life situation and (2) characterised by understandable and learning focused feedback that is linked to the task and criteria, enhances students self-efficacy.

The results do not confirm mastery experiences as being a stronger source of self-efficacy information than social persuasions. As argued earlier, providing

Table 1. Descriptive statistics and correlation matrix for assessment and self-efficacy.

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11
1 AUTTA	3.69	0.59	1	0.34	0.30	0.25	0.26	0.18	0.15	0.06	0.13	0.15	0.14
2 AUTVO	3.43	0.93		1.00	0.33	0.47	0.23	0.39	0.40	0.51	0.44	0.35	0.57
3 FEEDKT	3.58	0.74			1.00	0.57	0.31	0.18	0.16	0.18	0.24	0.08	0.25
4 FEEDKW	3.61	0.78				1.00	0.36	0.31	0.38	0.40	0.34	0.36	0.54
5 FEEDUSE	3.81	0.47					1.00	0.05	0.10	0.14	0.11	0.16	0.23
6 SEINT	79.44	12.23						1.00	0.73	0.63	0.67	0.59	0.64
7 SEPED	76.18	11.17							1.00	0.74	0.57	0.58	0.65
8 SESKM	78.64	9.57								1.00	0.74	0.67	0.74
9 SEORG	82.03	9.57									1.00	0.64	0.69
10 SECOL	82.01	10.53										1.00	0.70
11 SEREF	75.62	12.88											1.00

Note: Correlations in absolute value above 0.17 are significant at the 5% level, above 0.22 at the 1% level and above 0.28 at the 0.1% level.

Table 2. Multiple regression: Perceptions of assessment predicting student self-efficacy.

Self-efficacy Predictors	INT	β	PED	β	SKM	β	ORG	β	COL	β	REF	β
Block	Authenticity	0.33*	Authenticity	0.30*	Authenticity	0.43*	Authenticity	0.36*	Authenticity	0.25*	Authenticity	0.41*
	Feedback	0.17*	Feedback	0.26*	Feedback	0.22*	Feedback	0.18*	Feedback	0.30*	Feedback	0.37*
	$\Delta\beta$	0.16	$\Delta\beta$	0.04	$\Delta\beta$	0.21*	$\Delta\beta$	0.18	$\Delta\beta$	-0.05*	$\Delta\beta$	0.04*
$F(5,132)$	5.81	R^2	7.18	R^2	R^2	0.31*	7.58	R^2	6.71	R^2	20.29	R^2

Note: Bias-corrected bootstrap confidence intervals using 2500 resamples are used to test the effect of a block of predictors.

* p -value below significance level alpha of 0.05.

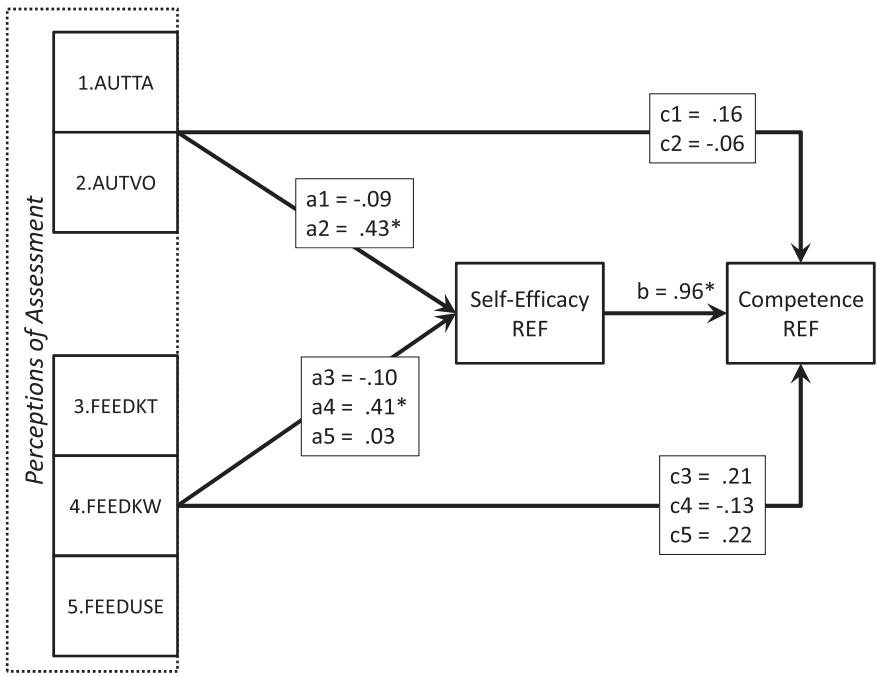


Figure 8. Standardised results of the mediation analyses: Perceptions of assessment through self-efficacy to the competence evaluation outcome REF.
Notes: The correlations between the perceptions of assessment measures are omitted for reasons of clarity. Indirect effects from perceptions of assessment over self-efficacy to competence evaluation outcome consist of the $a \times b$ product. REF = Competence for reflection and development with corresponding self-efficacy variable.

students with practice-oriented learning experiences is a necessary condition for acquiring mastery experiences, which is in turn the main source for the establishment of a firm sense of self-efficacy. However, not every practice-oriented learning experience itself leads automatically to a mastery experience. To provide students with mastery teaching experiences, educators have to tune the authenticity level of the learning experience, the structure of the situation and the supervision of the students to the complexity of the task and to the students' competence developmental level (van Dinther, Dochy, and Segers 2011). A possible explanation for the non-confirmation of Hypothesis 2 can be that the authenticity level of the formative competence assessment did not precisely match first-year student competence developmental level.

Another result of this study is the confirmation of Hypothesis 3. Logistic regression results revealed that student self-efficacy succeeds in making a reasonable prediction of student competence outcomes of the final end-of-year evaluation, on all of the six competence aspects. These results confirm the predictive role of self-efficacy as postulated by Bandura (1997). The practical relevance of these results can be illustrated by using the odds ratio. Taking the student efficacy SE-SKM subscale as an example, each extra point a student writes down on this self-efficacy subscale corresponds to a 1.36 times increase in the odds of passing on this competence. In terms of probability, a student who rates a degree of self-efficacy that is equal to the

Table 3. Logistic regression predicting the competence evaluation outcomes.

	<i>G</i>	<i>Df</i>	<i>p</i>	<i>R</i> ²	ΔG	ΔDf	<i>p</i>	<i>R</i> ²	ΔG	ΔDf	<i>p</i>
COMPINT											
0 Model	114.21	137		0.00							
Only PA	103.14	132	0.050 [*]	0.09	8.24	1	0.000 ^{**}	0.00	20.29	1	0.000 ^{**}
Only SE	99.89	136	0.000 ^{**}	0.11	4.99	5	0.420	0.06	2.41	5	0.790
PA and SE	94.90	131	0.000 ^{**}	0.16			0.000 ^{**}	0.20			
							0.000 ^{**}	0.22			
COMPSKM											
0 Model	190.26	137		0.00				0.00			
Only PA	168.03	132	0.000 ^{**}	0.14	74.13	1	0.000 ^{**}	0.07	17.86	1	0.000 ^{**}
Only SE	99.28	136	0.000 ^{**}	0.56	5.38	5	0.370	0.18	3.8	5	0.58
PA and SE	93.90	131	0.000 ^{**}	0.58			0.000 ^{**}	0.24			
COMPCOL											
0 Model	114.21	137		0.00				0.00			
Only PA	91.21	132	0.000 ^{**}	0.16	19.09	1	0.000 ^{**}	0.11	26.99	1	0.000 ^{**}
Only SE	86.49	136	0.000 ^{**}	0.18	14.37	5	0.010	0.28	4.78	5	0.440
PA and SE	72.12	131	0.000 ^{**}	0.32			0.000 ^{**}	0.31			

Notes: COMP = Evaluation outcome of the interpersonal competence (INT), pedagogical competence (PED), subject knowledge and methodological competence (SKM), organisational competence (ORG), competence for collaboration with colleagues (COL), competence for reflection and development (REF); *G* = deviance; *Df* = degrees of freedom Δ = Likelihood ratio test results of the model compared with model PA and SE. Generalised *R*² are reported to indicate the individual and joint contributions of perceptions of assessment (PA) and self-efficacy (SE).

**p*-value below significance level of 0.05.

***p*-value below significance level of 0.01.

Table 4. Indirect effects of perceptions of assessment through self-efficacy on competence evaluation outcomes.

Competence	INT			PED			SKM			Indirect Effects			ORG			COL			REF		
	β	95% CI		β	95% CI		β	95% CI		β	95% CI		β	95% CI		β	95% CI		β	95% CI	
Predictor																					
Task	0.04	[-0.06, -0.02]		0.02	[-0.17, -0.21]		-0.25	[-0.59, -0.07]		-0.05	[-0.27, -0.16]		0.04	[-0.15, -0.25]		-0.08	[-0.25, -0.05]				
Form	0.18	[-0.02, -0.39]	*	0.26	[-0.10, -0.49]	*	0.82	[-0.49, 1.19]	*	0.42	[-0.19, -0.70]	*	0.22	[-0.05, -0.43]	*	0.42	[-0.24, -0.62]	*			
Quantity	-0.01	[-0.13, -0.11]		-0.09	[-0.28, -0.04]		-0.13	[-0.41, -0.15]		0.05	[-0.16, -0.23]		-0.21	[-0.43, -0.04]	*	-0.10	[-0.28, -0.04]	*			
Quality	0.11	[-0.01, -0.34]		0.28	[-0.08, -0.55]	*	0.45	[-0.10, -0.83]	*	0.18	[-0.01, -0.44]	*	0.33	[-0.14, -0.64]	*	0.39	[-0.22, -0.60]	*			
Use	-0.06	[-0.19, -0.03]		-0.04	[-0.18, -0.10]		0.01	[-0.25, -0.25]		-0.04	[-0.24, -0.12]		0.03	[-0.12, -0.18]		0.03	[-0.10, -0.19]				

Note: Bias-corrected bootstrap confidence intervals are based upon 2500 resamples.
* p -value below significance level alpha of 0.05.

average degree in this sample ($SE-SKM=79$) has a 58% chance in obtaining this competence. A student who rates a degree of self-efficacy ($SE-SKM=88$) that is one standard deviation above the average degree in this sample, has a 96% chance and hence we can almost be certain that he passes this competence. For a student who rates degree of self-efficacy ($SE-SKM=69$) that is one standard deviation below the average self-efficacy degree in this sample, with a 7% chance to pass we can almost be sure that he fails for this competence. As a consequence of this result higher educational institutes should, in addition to supporting student competence development, pay attention to the monitoring and enhancement of students' developing self-efficacy because it predicts their future accomplishments.

In general, research regarding the role of student perceptions in education demonstrates moderate strength of relations between student perceptions and student learning and learning outcomes (Nijhuis, Segers, and Gijssels 2005; Segers, Gijssels, and Thurlings 2008; Segers, Nijhuis, and Gijssels 2006; Struyven et al. 2006). The last result of this study, concerning Hypothesis 4, is in line with these research findings and demonstrates that student perceptions of assessment have an indirect effect on student's competence evaluation outcomes through student self-efficacy: revealing that perceptions of assessment make a slight contribution on top of the influence of self-efficacy on competence evaluation outcomes. This implies that perceptions influence competence outcomes for the greater part on account of their impact on self-efficacy. The results of testing Hypothesis 1 revealed a pattern, including student perceptions of the form authenticity aspect and the quality feedback aspect as being the best predictors of student teacher self-efficacy. Testing the indirect effects of student perceptions of assessment on student competence evaluation outcomes through student self-efficacy, the same pattern applied, confirming the Hypothesis 1 result.

With respect to the research design, the measurement of the assessment characteristics and student teacher self-efficacy in the first part of the study was conducted simultaneously. The data of the competence evaluation outcome were collected in the second part of the study on another later time. The time difference in the study's second part supports our results regarding the predictive role of student teacher self-efficacy. Due to the correlational nature of the study's first half, the causality and direction of relationship between perceptions of assessment and self-efficacy must be interpreted with some caution. Nevertheless, the direction and size of the effects are in line with the pliability of self-efficacy of incipient students and the role of sources of self-efficacy according to social cognitive theory (Bandura 1997). Although we expect that study results apply to other student teachers, the homogeneity and size of the sample requires further affirming investigation among other and more heterogeneous samples of (upper year) student teachers.

The findings of this study, further our understanding in the processes and characteristics which are essential for the effectiveness of new learning environments such as competence-based education. However, the results of this study indicate some suggestions for further research. Firstly, due to the limitation of this study, a more elaborate longitudinal study design could confirm the direction of the proposed relationship between student assessment perceptions and self-efficacy. Secondly, regarding the result of Hypothesis 1 and according to Hattie and Timperly (2007), the type of feedback and the way it is given can be differentially effective. Further research is needed to investigate which type of feedback given within formative assessment is most influential for enhancing student self-efficacy. Finally, regarding the role of

mastery experiences as main source of creating self-efficacy and the result of Hypothesis 2, in-depth research is needed to investigate how students' perceptions of the assessment form authenticity aspect impact their self-efficacy.

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