

Educational Technology Expertise Center Open University of the Netherlands

Ph.D. research project proposal

This project falls in the following research topic(s):

- | | |
|-----------|--|
| Design | <input type="checkbox"/> Competency analysis / domain modelling |
| | <input type="checkbox"/> Learning tasks & learner support |
| Delivery | <input type="checkbox"/> Composing instructional messages |
| | <input type="checkbox"/> Computer-mediated communication |
| Diagnosis | <input checked="" type="checkbox"/> Performance-based assessment |
| | <input type="checkbox"/> Quality control & assurance |

1 Project chair	Name: dr. Y. Vermetten Function: Educational Technologist Department: Educational Technology Expertise Center (OTEC) Telephone: 045-5762397 Email: yvonne.vermetten@ou.nl
2 Project name	English: The supportive function of performance-assessment in student learning and their competency development. Dutch: De ondersteunende functie van performance-assessment in het leren van studenten en hun competentie-ontwikkeling.
3 Place in organization	Diagnosis theme in the Otec research program
4 Synopsis of the research problem	<p>In recent years, competency-based curricula are introduced in many studies in higher (professional) education. At this moment many of the curricula of the Open University of the Netherlands are being reformed and reorganized in line with CBE. However, the development of appropriate assessment systems that measure and support competency development lags behind. Yet, an adequate and valid assessment system could prove to be the touchstone for the success of introducing competency-based curricula.</p> <p>In CBE it is important to provide education based on study tasks, which give students the opportunity to realize a certain level of competence. In this process, information provided by competency testing will guide the students' future learning processes and competency development. The central purpose of this research is to develop a competency test that is supportive to student learning and their development of competencies. Methods from (industrial) assessment and development centers (ADC) offer good opportunities for measuring professional competencies in higher education, and for integrating assessment with coaching. The to-be-developed competency test for the present studies will be performance-based, provide supportive and functional information for future learning and competency development, is administered at several moments during the curriculum (not directly course bound), and informs students about the desired end-level of the performance so they can mirror their own strengths and weaknesses to this reference point.</p> <p>The research design implies that students participate in the competency test three times, approximately within a period of two years. Each administration forms one study of the total research project. The central research question of Study 1 concerns the construct</p>

validity of the test, which is an essential quality criterion for all kinds of assessment. Construct validity is conditional for the central goal of this project, namely the supportive function of performance-assessment in student learning and competency development. Studies 2 and 3 focus on the effects of the competency assessment on students' use of information for their competency development as evidence of consequential validity.

5	Research team	<u>Name and titles</u>	<u>Expertise/function</u>	<u>Department</u>
a	Project chair	Dr. Yvonne Vermetten	Educational Technology/ Educational Psychology	OTEC
b	Project-team	Vacant	Ph.D. student	OTEC
c	Other team members	Prof. dr. Jeroen Van Merriënboer Prof. dr. Cees Van der Vleuten Dr. Rob Martens two more members - not yet known	Educational Technology Educational Psychology Educational Technology	OTEC Maastricht University OTEC
d	Ph.D. supervisor	Prof. dr. Wim Jochems	Educational Technology, Head of OTEC	OTEC
6	Length of the project	Begin date: January 1, 2001 End date: January 1, 2005 Total length: 48 months		
7	Intended publications	<p><i>Three scientific publications in ICO accepted journals:</i></p> <ol style="list-style-type: none"> 1) An article on the construct validity of the competency test. 2) An article on the effects of the competency test on student learning and their competency development, influenced by different sorts of feedback and the students' level of self-regulated learning. 3) An article on the optimization of the support and feedback of the competency test and its' effects. <p><i>A Dutch 'vakpublicatie':</i></p> <ol style="list-style-type: none"> 4) An article on the development and evaluation of the practitioner's guide for competency testing. <p><i>Conference papers:</i></p> <ol style="list-style-type: none"> 5) Conference presentation in the United States (AERA) 6) Conference presentation in Europe (EARLI) 7) Conference presentation in the Netherlands (e.g. ORD or LDS) (preferably preliminary versions of the articles) <p><i>An academic dissertation.</i></p> <p><i>Instruments:</i> Guidelines and procedures (practitioner's guide) for the construction of competency testing.</p>		

In recent years, competency-based curricula are introduced in many studies in higher (professional) education. Competency-based education (CBE) in general refers to improving students' ability to deal with non-routine and abstract work processes, operate in ill-defined and ever-changing environments, understand dynamic systems and work in groups (Keen, 1992). In CBE students are expected to solve (authentic) problems by applying their knowledge in a manner that requires insight. This implies that students must have the ability to co-ordinate skills, knowledge and attitude in such a way that new problems can be solved or tasks can be handled (Van Merriënboer, 1999). The reason for growing attention in CBE is that the traditional emphasis of factual knowledge as such, does no longer meet the requirements of a changing society (Westera, 2001). Employers demand graduates that are able to operate in complex environments.

The Open University of the Netherlands (OUNL) provides distance education at the level of higher post-secondary education in several domains. It has adopted a competency-based instructional model for all of its studies in 1998. At this moment many of its' curricula are being reformed and reorganized in line with CBE. In this process the development of an alternative assessment approach is essential.

Many of the present curricula of the OUNL are still based on courses as building blocks. That is, students study a certain entity of subject matter (a module), end this by taking an exam and receive a certificate if performance is sufficient. Once the required number of courses are passed, a diploma will follow. In CBE it is important to provide education based on study tasks, which give students the opportunity to realize a certain level of competence. In this process, information provided by competency testing will guide the students' future learning processes and competency development. In CBE, therefore, assessments become the building blocks of curricula rather than courses (Instellingsplan OUNL, 1998).

Assessment in education can have two functions: a diagnostic function in which feedback to the student in function of future learning is the main goal (formative evaluation), and a judgmental function in which the judgement about the level of performance is the main goal (summative evaluation). Assessment in CBE as outlined above mainly serves the function of formative evaluation. Both functions are useful in education, but the present research project is confined to the formative function of assessment. The central purpose of this research is to *develop a competency test that is supportive to student learning and their development of competencies*.

This concurs with the statement that educational assessment has its' most important challenge in doing a better job of facilitating learning (Linn, 1989; Dochy & McDowell, 1997). In the evaluation literature discontent with traditional ways of monitoring learning progress is often expressed, especially with regard to establishing growth in student performance (e.g., Moerkerke, 1996). Assessment of performance is needed that can inform the student and the institution about how individual targets can be achieved, and not only in how far educational goals are attained. The question is "...how evaluation of learning progress can be connected to steering and redirecting a student's future learning and competence development" (Tillema, Kessels & Meijers, 2000, p. 268).

Performance-based assessment is the kind of assessment that seems to fit a CBE curriculum and that can serve the function of supporting student learning and competency development within such a context. Current views on instruction and human learning affirm that the intent of instruction is to promote higher-order

thinking, problem-solving and meaningful understanding (cf. CBE). Lane & Glaser (1996) state that if assessments are to be aligned with those views, they must more closely resemble meaningful and authentic tasks (i.e., performance-based assessment). Ideally, performance-based assessment requires students to actively accomplish complex and significant tasks, while bringing to bear prior knowledge, recent learning, and relevant skills to solve realistic or authentic problems (Hambleton, 1996). Exhibitions, investigations, demonstrations, written or oral responses, journals, and portfolios are examples of performance-based assessment.

Methods from (industrial) assessment and development centers (ADC) offer good opportunities for measuring professional competencies in higher education, and for integrating assessment with coaching (Eringa, Rietveld & Zwaal, 1999). What's more, if ADC-methods used in education concentrate on the core problems of the professional field, the connection between the 'world of knowledge' and the 'world of work' becomes closer (cf. Van Merriënboer, 1999). Tillema, et al. (2000) offer a framework showing how to organize curriculum and instruction around competencies in higher vocational education. In this, an 'Educational Development and Assessment System' (EDAS) is introduced to illustrate the integration of assessment with instruction.

EDAS was launched in 1997, at the Enschede Institute for Higher Education for Small Businesses and Retail Management. It is a performance-based assessment system that is not course bound, but is maintained over extensive periods of the curriculum. The philosophy is that it is essential to link assessment with instruction that is focused on performance and aligned with later work. It provides careful diagnosis and monitoring of the learner's progress during the course of competency development. Next to information about competency attainment, it provides cues for further specific training or development activities. EDAS includes three instruments: (a) a portfolio as a dossier giving proof of a person's mastery, (b) a development center as a set of work-related simulation exercises, and (c) self- and peer-assessment. In particular, the combination of the portfolio and the development center are suited to monitor and test performance growth over longer periods of time. EDAS was designed to achieve a better match between student learning and the competencies to be attained.

The to-be-developed competency test for the present studies will use EDAS as an example, because the purposes of both assessment systems correspond to a large extent. Therefore, the following characteristics of the present competency test are suggested. First of all, the test must be performance-based. Second, its main function is to provide supportive and functional information for future learning and competency development. Further, the competency test must focus on one or two core competencies, that play an essential role throughout the curriculum and in the future profession. This means that the competency test not is directly coupled to specific courses, but is administered at several moments during the curriculum. Because the major goal of the test is to support competency development, it must inform students about the desired end-level of the performance. That way students can anticipate on the expected end level of core competencies, which will offer a baseline reference point to which own strengths and weaknesses can be mirrored.

The instructive function of the competency test in this project will highly depend on the information it provides. The feedback that is given will be essential for the students' future learning and competency development. Feedback is an inherent catalyst for all self-regulated learning activities (Butler & Winne, 1995). Effective feedback must be functional and provide cues for further specific training or development activities. According to Martens & Dochy (1997) feedback with instructional guidelines is preferred.

It can be doubted if all students will interpret and use the (implicit or explicit) instructive information of the competency test in a similar way. There is reason to expect that any learning environment does not influence learning in a direct fashion, but that learner characteristics will moderate these effects (Elen & Lowyck, 1998; Martens & Dochy, 1997; Vermetten, 1999). Our study into the effects on student learning therefore should take into account possible interactions and must not only look for average or main effects (cf. Martens, 1998). In this case it is chosen to involve one relevant learner variable in the analyses, and that is the level of self-regulated learning (e.g., Butler & Winne, 1995). It is expected that high levels of self-regulated learning will positively influence the way students use the information provided by the competency test in their future learning.

In the design that is chosen for this research the same group of students participate in competency testing three times during their study, approximately within a period of two years. The central goal of the test is to provide students with support and input to direct the future development of their competencies. A longitudinal design is chosen so that students can reflect on their own development. If they receive information of their competency at several points in time in relation to the expected end level, they are given the opportunity to take a developmental perspective on their competence. A longitudinal design is also needed because some practice and experience (by students and teachers) is probably required before the competency test can be expected to have the desired consequences. The precise filling-in of the three studies and the research questions are described in section c (design and methods).

b Scientific importance of the research, including the importance for the Open University of the Netherlands and the place of the research in the Otec Research Program

The Open University has adopted an educational model in which competency development is the central theme. At this moment, many of the curricula are being reformed towards the competency-based model. However, the development of appropriate assessment systems that measure and support competency development lags behind. Yet, an adequate and valid assessment system could prove to be the touchstone for the success of introducing competency-based curricula (cf. Tillema, et al., 2000).

Earlier research at the OUNL has shown that progress assessment is highly appreciated and used to a very high extent by OUNL students (Martens, 1998; Martens & Dochy, 1997; Martens & Hermans, 2000). However, these experiments were all based on traditional courses and were not in the line with the current orientation towards CBE. Many researchers have stated that assessment should be in line with the educational approach and learning goals (e.g., Biggs, 1996; Dochy & McDowell, 1997). If not, educational innovations may fail since students tend to orient on the assessment that is not in line with this innovation. In other words, assessment determines to a high extent how students actually learn. In a lab researchers can ask students to read texts but in 'real life' students have their own 'hidden curriculum', "...adopting ploys and strategies to survive in the system" (Lockwood, 1995, p. 197). Therefore, developing adequate competency testing is a crucial part of CBE. There are only very few experiences with this form of assessment in CBE, so also for the OTEC research program this research is important.

c Design & Methods

In the chosen design students participate three times in competency testing in order to

gain support and input to direct the development of their competencies. The three studies are based upon each other in the sense that results of the former studies provide input for designing the next study. In the first study, the administration of the competency test serves as a practice situation in which students, teachers and researchers first experience what the test is all about, and how it works. The central research question here concerns the construct validity of the test, which is an essential quality criterion for all kinds of assessment (Messick, 1994). Construct validity is *conditional* for the central goal of this project, namely the supportive function of performance-assessment in student learning and competency development.

The supportive function of assessment in student learning can also be put in the frame of validity research. In the literature this is referred to as *consequential validity* (Linn, Baker & Dunbar, 1991; Messick, 1989, 1994). According to Messick (1994) evaluation of consequences of any testing is integral to the validation of test interpretation and use. Evidence about the intended and unintended effects of assessment on the way students and teachers spend their time and think about the goals of education must be collected. Although Messick (1989) stressed the criticality of giving attention to the consequential basis of validity, it has only become a major criterion with the rise of authentic and performance assessment (Linn, et al., 1991).

Studies 2 and 3 focus on the effects of competency assessment on student learning as evidence of consequential validity. The second study consists of an experiment with a one-way between-subjects design. Half of the students will receive elaborate feedback, but no directions for further learning and development. The other half receives elaborate feedback combined *with* directions for further learning and development. Furthermore the level of students' self-regulated learning is taken into account as a mediating factor in this whole. The third study is a design experiment in which the goal is to optimize the provided information and support, based on the results of the second study. Again, the consequential validity in terms of students' use of information from the test will be examined. Elaboration of the three studies will follow below.

The educational context in which the research takes place has to meet certain requirements. The first requirement is that a competence map of the curriculum should be available or under construction. Related to this is, of course, that the curriculum should be competence-based, or is reforming into CBE. Maybe the most ideal situation would be if the competency test could be developed simultaneously with the development of a CBE curriculum. A practical consideration is the possibility to embed the competency test in the regular curriculum, to avoid that students conceive of it as an additional and unimportant part. In order to ensure this, it could be considered to include the competency test in the grading (to a small part). Furthermore, participation in the competency test will take extra time, so study credits should be allowed for this activity.

In line with the OTEC policy an integration between the research program and the development program is aimed for. The development program aims to develop forms of assessment for measuring competencies at a curricular level. This starting point fits the present research proposal and therefore offers opportunities for co-operation. Possibilities for this will be explored when an adequate research context is sought for (i.e., within the first four months of the project).

Study 1: Construction and construct validity of the competency test

Which procedures and guidelines are suitable for constructing competency testing? How do teachers evaluate the practitioner's guide? Can evidence of construct validity be found?

In the first study procedures and guidelines for constructing competency testing will be developed and evaluated. In the first phase of this study a literature-survey will result in a proposed set of procedures and guidelines. These procedures and guidelines will serve as a practitioner's guide to construct a competency test. A team of domain-experts, teachers and researchers will work on the construction of a competency test. This includes the development of performance-based tasks (or problems), measurement instruments (such as explicit end-criteria, scoring lists, and norms for different levels of competency), and a training for the assessors. The usefulness and shortcomings of the practitioner's guide will be evaluated in a systematic way. Interviews or questionnaires will be used for this purpose.

Then the competency test will be applied in the curriculum for the first time. The main research question concerns the construct validity of the test. Messick (1989, 1994) stated there are two general types of threat to construct validity: construct underrepresentation and construct-irrelevant variance in the test. In the first case the test is too narrow and fails to include important dimensions or facets of the construct. Construct-irrelevant variance means the test measures too much variance that is irrelevant to the construct. Both aspects will be examined. An additional validity criterion relevant to this research is *transparency* or meaningfulness (Frederiksen & Collins, 1989; Linn, et al., 1991). The assessment has to have meaning to students and teachers, and be a meaningful instructional experience in itself. Students have to be aware of the criteria and the construct that is measured, and must recognize the relevance in relation to the objectives of the curriculum (Messick, 1994).

Sources of evidence for the mentioned aspects of validity can have many forms, such as judgmental and logical analyses (e.g., comparing with competence map), correlational studies (e.g., relating test scores to other variables), analyses of process (i.e., directly probe processes underlying task performance, e.g., by means of protocol analysis), etc. (Messick, 1989). A decision for appropriate methods and relevant data for the present study can best be made during the preparation of the competency test. Between Study 1 and Study 2 the competency test will be improved, based on the findings.

Study 2: Experiment with one-way between-subjects design

What are the effects on student learning and their development of competencies if students receive elaborate feedback with directions for further development (first condition) against elaborate feedback without directions for further development (second condition)? Does the level of students' self-regulated learning play a (mediating) role in those effects?

In this study an experiment will be carried out in which two conditions are created with respect to the sort of information provided by the competency test. All students take part in the competency test for the second time during the curriculum, but the sort of feedback they receive will differ. In one condition elaborate feedback will be combined with directions for further learning and development. The other condition will provide elaborate feedback, but no directions for further learning and development.

Before the second administration of the competency test, the level of students' self-regulated learning will be measured. An appropriate measurement instrument will be selected from literature (e.g., Pintrich & De Groot, 1990; Vermunt, 1998). The OTEC research project of Van den Boom (2000) includes the development of an instrument for measuring the competence of self-regulated learning, and might be useful for the present purpose.

After the second administration of the competency test, data on the independent variables will be gathered. The effects on student learning and their competency

development are operationalized as (1) the interpretation and translation of the information provided by the competency test, (2) the choices, intentions and plans based on this interpretation, and (3) the way students actually use the information to direct their learning process and competency development (such as choosing own goals, choosing to adopt certain roles, choosing certain learning experiences, asking for specific feedback etc.).

It is suggested that the first and second variable be measured by means of a learning contract, including a written interpretation of the information that was provided, personal learning objectives for competency development, and a detailed plan for attaining these goals. For the third variable a student portfolio is suggested, i.e., a purposeful collection of learning examples collected over a period of time (e.g., Brown, Bull, & Pendlebury, 1997; Elsen, 2000). To be appropriate for its purpose, the portfolio should have a structured format in which a clear connection between the competency test and the students' actions is stressed. Criteria for the quality of the learning contract and student portfolio have to be made explicit.

The hypothesis is that the condition 'elaborate feedback with directions for further learning' provides the most useful information for students' future learning (cf. Martens & Dochy, 1997), thus resulting in more purposeful choices and actions of the students. Finally it is expected that students with high levels of self-regulated learning are better at directing their own competency development, regardless of the sort of feedback.

Study 3: Design experiment: Optimizing the feedback

What are the effects on student learning and their development of competencies if the feedback and support are redesigned on the basis of former results? Are results generalizable across student groups?

The goal of the third study is to improve the provided feedback and support, so that students' use of it will be optimized. Results of the former study will be used for redesigning the feedback and support. The design questions are: How can the quality of information from the competency test be sophisticated? How can students be coached in their interpretation and use of the information provided? Is differentiation of support and feedback needed based on students' level of self-regulated learning, and how could this be accomplished?

Effects of the improved feedback and support are examined in a similar vein as in the second study (i.e., by means of learning contracts and student portfolios). If possible, the third version of the competency test will simultaneously be applied in a different group of students, to examine the generalizability of the effects. Possibly, the next generation of students within the same curriculum could form a replication group and serve this purpose.

d Literature

- Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education*, 32, 347-364.
- Brown, G., Bull, J., & Pendlebury, M. (1997). *Assessing student learning in higher education*. London [etc.]: Routledge.
- Butler, D.L., & Winne, P.H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research*, 65, 245-281.
- Dochy, F., & McDowell, L. (1997). Assessment as a tool for learning. *Studies in educational evaluation*, 23, 279-298.
- Elen, J., & Lowyck, J. (1998). Students' views on the efficiency of instruction: An
-

-
- exploratory survey of the instructional metacognitive knowledge of university freshmen. *Higher Education*, 36, 231-252.
- Elsen, M. (2000). Toetsen [Assessment]. In J. Nedermeijer & A. Pilot (Eds.), *Beroepscompetenties en academische vorming in het hoger onderwijs* [Professional competencies and academic training in higher education] (pp. 159-188). Groningen, Netherlands: Wolters-Noordhoff.
- Eringa, K., Rietveld, J., & Zwaal, W. (1999). De leerwaarde van toetsen [The instructional value of assessment]. In G. Heijnen & S. Meeder (Eds.), *Toetsen en ICT in het hoger onderwijs* [Assessment and ICT in higher education] (pp. 124-135). Utrecht, Netherlands: Stichting SURF.
- Frederiksen, J.R., & Collins, A. (1989). A systems approach to educational testing. *Educational Researcher*, 18(9), 27-32.
- Hambleton, R.K. (1996). Advances in assessment models, methods and practices. In D.C. Berliner en R.C. Calfee (Eds.), *Handbook of educational psychology* (pp. 899-925). New York, NJ: MacMillan.
- Instellingsplan 1998-2001 Open Universiteit Nederland (1998). *Verandering in perspectief* [Change in perspective]. Heerlen, Netherlands: Open Universiteit.
- Keen, K. (1992). Competence: What is it and how can it be developed? In J. Lowyck, P de Potter & J. Elen (Eds.), *Instructional design: Implementation issues* (pp.111-122). Brussel: IBM International Education Center.
- Lane, S., & Glaser, R. (1996). Assessment in the service of learning. In E. de Corte & F.E. Weinert (Eds.), *International encyclopedia of developmental and instructional psychology* (pp.805-808). Oxford: Pergamon.
- Linn, R.L. (Ed.). (1989). *Educational measurement, 3rd edn*. New York: MacMillan Inc.
- Linn, R.L., Baker, E.L., & Dunbar, S.B. (1991). Complex, performance-based assessment: Expectations and validation criteria. *Educational Researcher*, 20(8), 5-21.
- Lockwood, F. (1995). Students' perception of, and response to, formative and summative assessment material. In: F. Lockwood (Ed.), *Open and Distance Learning Today* (pp. 197-207). London: Routledge.
- Martens, R.L. (1998). *The use and effects of embedded support devices in independent learning*. Ph.D. Thesis. Utrecht: Uitgeverij Lemma BV.
- Martens, R., & Dochy, F. (1997). Assessment and feedback as student support devices. *Studies in educational evaluation*, 23, 257-273.
- Martens, R., & Hermans, H. (2000). Internet based formative prior knowledge assessment. *Studies in educational evaluation*, 26, 245-258.
- Messick, S. (1994). The interplay of evidence and consequences in the validation of performance assessments. *Educational Researcher*, 2, 13-23.
- Moerkerke, G. (1996). *Assessment for flexible learning* [Academic dissertation]. Utrecht, The Netherlands: Lemma.
- Pintrich, P. R., & De Groot, E. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82, 33-40.
- Tillema, H.H., Kessels, J.W.M., & Meijers, F. (2000). Competencies as building blocks for integrating assessment with instruction in vocational education: a case from The Netherlands. *Assessment & Evaluation in Higher Education*, 25, 265-278.
- Van den Boom, G. (2000). *Reflection prompts and feedback as a means to foster the self-regulated learning competence* [Research proposal]. Open University Netherlands: OTEC.
- Van Merriënboer, J.J.G. (1999). *Cognition and multimedia Design* [Inaugural Address]. Open University of the Netherlands.
- Vermetten, Y. (1999). *Consistency and variability of student learning in higher education*. [Academic dissertation]. Tilburg, Netherlands: Tilburg University.
- Vermunt, J. D. (1998). The regulation of constructive learning processes. *British Journal of Educational Psychology*, 68, 149-171.
- Westera, W. (2001). Competences in education: a confusion of tongues. *Journal of*
-

Curriculum Studies, 33 (1), 75-88.

Westera, W., & Sloep, P.B. (1998). The virtual Company: Toward a self-directed, competence-based learning environment in distance education. *Educational Technology*, 38(1), 32-37.

9 Work program and planning	Month	Activity and product
	1-4	- literature study, develop practitioners' guide - find appropriate research context
	5-9	construction of competency test, measurement instruments, and determine method(s) for construct validation
	10-12	setting up/conducting Study 1
	13-14	data analysis
	15-18	report Study 1 - Dutch article - conference paper - scientific article 1
	19-21	preparing materials (e.g., measurement instruments, improving competency test, various types of feedback) for Study 2
	22-25	setting up/conducting Study 2
	26-27	data analysis
	28-30	report Study 2 - conference paper - scientific article 2
	31-32	preparing materials (e.g., optimized feedback) for Study 3
	33-35	setting up/conducting Study 3
	36-37	data analysis
	38-40	report Study 3 - scientific article 3 - conference paper
	41-48	writing final report/dissertation
