Ko-NaMa – Simulation-based measurement and validation of a competence model for sustainability management

Seeber, S., Hartig, J., Dierkes, S., Schumann, M.

Abstract
The co-operative project Ko-NaMa aims at the validation of a multidimensional competency model for sustainability management. A total of three test components is to be implemented: (1) a test aiming at the measurement of declarative knowledge in the domain of sustainability management, (2) a test assessing declarative and procedural knowledge in business administration, aiming primarily at economic concepts and corresponding efficiency-geared decision-making, and (3) a complex simulation-based test, in which authentic business situations related to problems of sustainability are represented. In addition, several validation studies are projected which are intended to provide empirical evidence substantiating the underlying competency model. These studies comprise analyses examining the curricular validity of assessments in the tertiary sector, the significance of the measured competencies for making decisions, as well as the corresponding construct validity. In the context of an intervention study involving the application of a specific training component for sustainability management in three locations, the effects of specific learning opportunities are to be investigated. Control groups are to be recruited among students from locations, where learning opportunities concerning sustainability management are provided either based on a general societal perspective or by way of integrating them into existing modules in the field of business administration.

Aims and Research Questions
Within the co-operative project Ko-NaMa, three aims are pursued: 1. validation of a competency model for sustainability management, 2. implementation and evaluation of a pertinent intervention, 3. analysis of variables influencing the emergence and development of respective competencies.

Theoretical Framework
The competency model for sustainability management is underpinned by a business model linking a systemic- with a process-based perspective. In this model, enterprises are complex systems embedded in specific changing environments and interact with different stakeholder groups. From a process perspective, the value chain consists of business, management and support processes (cf. Ruegg-Stürm, 2005), which allows to identify relevant management requirements in enterprises and to analyse the domain of acting. Additionally, we take into account the decision theory which tries to identify the optimal alternative for different preferences in a given situation. Thus, both concepts are suitable to model requirements concerning sustainability management in business contexts in an appropriate way. With regard to sustainability management, a differentiation of sustainability into the three dimensions economy, ecology and social issues is prevailing (Elkington, 1999). Taking this approach as a basis, problems of sustainability in the entire value-added chain can be determined. The implementation of sustainability in companies is connected with decisions which are accompanied by normative ideas, problem formulation, target definition processes and with the design of models which facilitate the identification and assessment of action alternatives. On the basis of a decision-orientated approach, it is at the same time possible to overcome the contrast between the measuring of “dispositions” (Competence) and the observation of “behaviour” (Performance), by including situation analysis, problem definition, target formulation and decision as constitutive factors each (cf. Blömeke, Gustafsson, & Shavelson, 2015, 7). For this purpose, test methods are applied which are both authentic, i.e. approximated to corporate reality, as well as computer- and simulation-based.
Competence in sustainability management are defined as a complex ability to act adequately in business contexts, in particular to be able to take into account the medium- and long-term economical, ecological and social – intra-company as well as external – consequences of management decisions. Illustration 1

shows the (preliminary) competency model for sustainability management. Preliminary work on competency modelling in commercial and business administration professions showed that such knowledge is of substantial importance – contrary to some assumptions and explanatory models in the area of environmental education (see critical opinion by Lehmann, 1999; Roczen, 2011). These preliminary studies have shown, however, that decisions on sustainability do not exclusively depend on the knowledge about sustainability, but that affectional-motivational dispositions regarding sustainability are important determinants of the decision on how to act, as well (cf. Seeber & Michaelis, 2014). Since the situations concerning sustainability management are differing in complexity, competency modelling takes into account differently demanding modelling capabilities in terms of cognition as well as different levels of information networking.

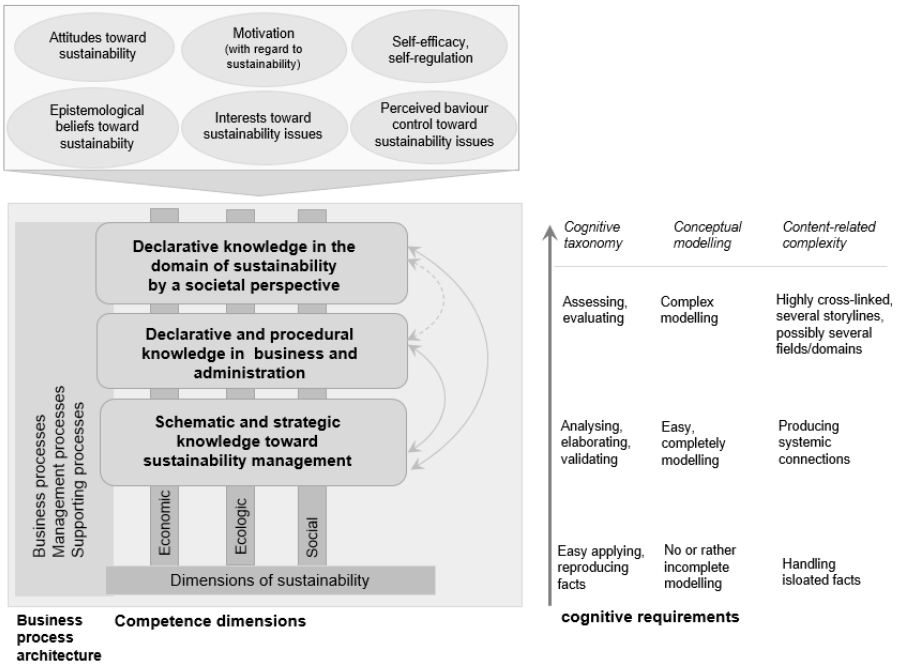

Fig. 1: competency structure model "Operational sustainability management (cf. Seeber, & Michaelis, 2014; Winther, 2010; kinds of knowledge see Shavelson, Ruiz-Primo, & Wiley, 2005, Rüegg-Stürm, 2005).

Study Design

The central aim of the project is the validation of the competency model of sustainability management. The competency model and the planned assessment takes into account different kinds of knowledge. Thus, the measurement requires also different test accesses (cf. Shavelson, Ruiz-Primo, & Wiley, 2005, S. 415 et seq.). The declarative knowledge about generally prospects for sustainability as well as the declarative knowledge in business administration will be assessed by closed and brief open answer test formats. For measuring procedural, schematic and strategic knowledge closely related to action and business decision making in complex situations (including perception and interpretation of a specific management situation, problem formulation, target definition, perspective taking, decision making a.s.o.) a performance assessment is needed and may mediate between disposition and performance. For this purpose, a computer-based authentic assessment with simulations of real business problems under the perspective of sustainability in companies will be implemented.

First curricular analyses on the integration of sustainability issues into business administration studies refer to three central guiding principles of anchoring: (a) Basic modules on sustainability are offered from a societal perspective as interdisciplinary approach and thus usually without domain-specific integration (b) Sustainability issues are included into different basic and specialized business administration modules on an integrative level. (c) Specific modules on sustainability management are offered along selected operational function areas or on a cross-functional level. In the context of the planned intervention study

involving the application of a specific training component for sustainability management at three universities, the effects of specific learning opportunities are to be investigated. Control groups are to be recruited among students from universities, where learning opportunities for sustainability management are provided either based on a general societal perspective or by way of integrating them into exiting business administration modules. Furthermore, experts' judgments of the representativeness and quality of tasks sampled are used to examine validity claims.

Test items have been developed which are taken to be scalable according to Latent-Trait Models (Rasch and Partial-Credit) and/or Latent-Class Models, if applicable. The structure assumed in the competency model will be subjected to confirmatory procedures. With regard to the intervention and control groups, the invariance of measurement between the groups will be tested by appropriate methods (e. g., multi-group-IRT analyses). In this context, "differential item functioning" (DIF) should not only be considered as a source of error variance and as indicative of a lack of criterion validity. Instead, it could be considered as a result of different learning opportunities leading to different group profiles with regard to the same construct (Scheuneman, & Gerritz, 1990). In order to measure changes in the proportions of students meeting proficiency in sustainable management over two occasions within the intervention study, growth models are used in which the performance at the different times of testing is scaled in terms of two latent dimensions. The analysis of changes over time is facilitated by the application of anchor items and the use of a multi-matrix design.

Project data

Project management:	Prof. Dr. Susan Seeber (Georg-August-University of Göttingen) Prof. Dr. Johannes Hartig (German Institute for International Educational Research (DIPF), Frankfurt) Prof. Dr. Stefan Dierkes (Georg-August-University of Göttingen) Prof. Dr. Matthias Schumann (Georg-August-University of Göttingen)
Contact	Prof. Dr. Susan Seeber Georg-August-University of Göttingen, Department of Business Education and Human Resource Development Platz der Göttinger Sieben 5; 37073 Göttingen Fon: +49 (0) 551 39 4421; E-Mail: susan.seeber@wiwi.uni-goettingen.de
Homepage	http://www.uni-goettingen.de/en/531774.html
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