

Studies in Problem-Based Hospitality Management
Education

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A submission in partial fulfilment of the requirements of
the University of Derby for the award of the degree of
Doctor of Philosophy by Published Works

Centre for Contemporary Hospitality and Tourism

College of Business, Law and Social Sciences

December 2020

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Studies in problem-based hospitality management education

Critical Appraisal

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ABSTRACT

This critical appraisal discusses and contextualizes the published works in order to demonstrate how the studies contribute to the knowledge about and development of problem-based learning (PBL) in the context of hospitality management education. Studies cover several aspects of problem-based learning illustrating strengths and challenges on both the conceptual and operational level related to the design and delivery of this educational concept in hospitality management education.

First an overview will be provided of the basic principles for learning and a rationale for choosing problem-based learning as a promising educational concept for hospitality management education (HME).

Next, research is reported on experiences and challenges with implementing and operationalising the key principles of PBL: constructive, collaborative, contextual, self-directed learning.

Problem-based learning is an approach to education reflecting a constructivist conception of knowledge, teaching, learning and assessment. Studies were conducted to investigate whether these conceptions are shared and supported by staff and students, as a crucial condition for successful implementation of PBL.

Regarding the operational level of PBL, results are reported of studies on some key drivers of the PBL process like the task, the seven-step procedure, teamwork, tutor interventions, and testing.

In the final section of this critical appraisal some implications of the studies for the new educational concept design-based education (DBE) and curriculum configuration are discussed, including suggestions for further design-based research. The guiding question for this critical appraisal will be: what did the studies contribute to the knowledge about and development of problem-based learning and innovation in hospitality management education?

Keywords: problem-based learning, conceptions of education, seven-step procedure, concept mapping, tutor interventions, assessment, design-based education

A RATIONALE FOR PROBLEM-BASED HOSPITALITY MANAGEMENT EDUCATION

Problem-based learning is considered to be ‘one of the few curriculum-wide educational innovations surviving since the sixties’ (Schmidt, Van der Molen, Te Winkel, & Wijnen, 2009, p.2). The educational concept of PBL was developed when designing a new medical program at McMaster University Canada that started in 1969. The objectives and outline of the program were formulated by its founding Dean – John Evans – and the Education Committee: Bill Spaulding (chair), Fraser Mustard, Jim Anderson and Bill Walsh. The name ‘problem-based learning’ was invented and first used by Howard Barrows in an article published in 1974 (Servant-Miklos, Norman, & Schmidt, 2019).

In 1974 Maastricht University implemented the approach in their new medical school. Some of the major adaptations to PBL that they introduced were structuring the tutorial process by introducing the Seven Steps and PBL-trainings for tutors and students, the invention of skillslabs, and the introduction of the progress test. They also installed a department for Educational Research & Development that carefully monitored and documented the implementation of PBL.

When in 1987 a new hotel school was opened in the north of the Netherlands, the founding fathers – Herman Bierma and Hans Otting – who were both trained and familiar with the Maastricht version of PBL, decided to implement the educational concept as the integral approach to the curriculum. Four principles of curriculum design were formulated: thematic, modular, interdisciplinary, PBL.

The rationale for choosing PBL were based on insights from the educational sciences, experiences and reported research about PBL, rules & regulations and characteristics of students, industry and the profession.

Principles and theoretical foundations of PBL

In the current literature on learning and instruction the traditional view that knowledge has to be transferred from the teacher to the students has been challenged (Bereiter, 2002; Philips, 1995, 2000). Studies on cognition and learning have shown that knowledge consists of conceptual networks which have to be activated, elaborated and reconstructed by the students for learning to take place (Schmidt, 1983; Schmidt, Rotgans & Yew,

2011). From an epistemological point of view it could further be questioned whether knowledge is an individual property or rather a social phenomenon, that is: something which is discovered, constructed and shared with others. In higher education constructivism seems to have emerged as the leading theory advocating a constructive, contextual, collaborative and self-directed approach to learning. One of the approaches to education which has incorporated these constructivist principles is problem-based learning (Savery & Duffy, 1995; Savin-Baden, 2000; Otting & Zwaal, 2007).

Two important cognitive psychological principles to support PBL are the activation-elaboration hypothesis and the situational interest hypothesis (Schmidt, Rotgans & Yew, 2019). The first one states that in order to expand or correct the existing knowledge network and to make structural changes to a mental model, it should be made explicit and available for scrutiny. Confronted with a problem that requires explanation, students are triggered to activate their prior knowledge and to elaborate on their initial ideas by challenging each other's assumptions and by testing their hypotheses using additional sources of information.

The situational interest hypothesis states that problems or puzzles create a desire in students to find out more about the topic, leading to more increased concentration, focused attention and willingness to learn (Schmidt, Rotgans & Yew, 2011).

Other theoretical foundations for PBL are Dewey's views on experiential education, Vygotsky's ideas about sociocultural constructivism and the theory of situated learning (Hung, Moallem & Dabbagh, 2019).

The key components of PBL

The key characteristics of PBL are (Schmidt, Van der Molen, Te Winkel, & Wijnen, 2009):

1. *The use of problems as the starting point for learning*
2. *Small-group collaboration*
3. *Flexible guidance of a tutor*
4. *Number of lectures is limited*
5. *Learning is to be student-initiated*
6. *Ample time for self-study.*

Several of these elements are covered by the studies included in this critical appraisal. Components that will be discussed in the sections that follow are the task or problem as the trigger for learning, the seven steps procedure as a scaffold for learning, the collaboration and teamwork in the tutorial group, the tutor as facilitator and role-model, and last but not least the design of an appropriate assessment mix for problem-based learning.

Various formats of PBL

Since its inception at McMasters many different variations of PBL have been developed in different countries and programs. Barrows (1986) proposed a taxonomy of PBL-methods using two dimensions (self-directedness and problem structuredness), with three levels each (high, medium, low). The six resulting approaches are: Lecture-based with problem solving activities; Case-based Learning; Project-based Learning; Anchored Instruction; Hybrid PBL; Pure PBL (Hung, 2011).

In Aalborg PBL is combined with project-based learning in what is called Project Oriented – Problem Based Learning (PO-PBL) (Hernandez, Ravn, Valero, 2015).

At the Republic Polytechnic in Singapore they introduced the One Day, One problem PBL approach, in which the full cycle of problem analysis, self-study, and synthesis is conducted within the timeframe of 1 day (O’Grady, Yew, Goh, & Schmidt, 2012).

In her analysis Savin-Baden (2014) distinguishes 9 different constellations of PBL using problem type, level of interaction, focus of knowledge, form of facilitation, focus of assessment, and learning emphasis as parameters.

Schmidt, Van der Molen, Te Winkel & Wijnen (2009) distinguished three different interpretations of PBL:

1. Cognitive-constructivist approach to education; “The idea here is that the central goal of PBL is to help students build flexible mental models of the world” (o.c., p.229).
2. PBL as a process of inquiry. “The goal of PBL is here to help students learn the skill of diagnostic reasoning by mimicking the thinking processes of the expert” (o.c., p.230).

3. PBL as a tool for ‘learning how to learn’. In this view, knowledge develops so fast as a result of expanding science efforts that it is more important to acquire skills on how to learn than to learn subject matter (o.c., p.230).

Two further variations related to specific stages of the PBL process are the use of study teams during the self-study stage (Moust, Roebertsen, Savelberg, & De Rijk, 2005) and the introduction of an individual reflection paper to report on the activities conducted between tutorial meetings (Johansson & Svensson, 2019).

PBL compared to other educational concepts

Some alternative educational concepts that show similarities with PBL are Case-based learning, Project-based learning, Inquiry-based learning, and Learning by Design. Savery (2019) compared these five pedagogical models, using the following parameters: role of the *instructor*, role of the *learner*, format of the *task*, access to *resources*, and *assessment*. In comparison to PBL Case-based learning is more teacher-centered, allows less self-directed learning and uses more structured problems. Regarding Project-based learning and Inquiry-based learning the similarities with PBL outweigh the differences. Compared to PBL the role of the teacher is slightly more directive, the task more structured or the resources pre-selected by the teachers. Learning by design (LBD) is developed as ‘a project-based inquiry approach to science learning with roots in case-based reasoning and problem-based learning’ (Kolodner et al., 2003), integrating the strengths of the other educational concepts. But as Savery indicates: “Critical to the success of this approach are well-designed challenges for the students and teachers who are knowledgeable in both the discipline and the application of the pedagogical model” (Savery, 2019, p.101).

The performance of PBL

Several meta-analyses have been performed to test the effectiveness of PBL and its components (Dochy, Segers, Van den Bossche & Gijbels, 2003; Gijbels, Dochy, Van den Bossche & Segers, 2005; Savin-Baden & Wilkie, 2004; Schmidt, Van der Molen, Te Winkel & Wijnen, 2009; Strobel & Van Barneveld, 2009; Van den Bossche, Segers, Gijbels & Dochy, 2004; Walker & Leary, 2009).

Dolmans et al. (2005) distinguish between reviews conducted in 1990s that were focused on testing the theoretical claims of PBL and reviews conducted since 2000 that focus on comparing curricula.

Results of the earlier studies confirm that PBL stimulates students towards constructive, collaborative and self-directed learning and that contextual learning promotes transfer.

The curriculum comparison studies show a mixed picture. Newman (2003) in a meta-analysis of 14 studies concluded that the outcomes for students in the PBL groups were less favourable than those in the control group. Dochy, Segers, Van den Bossche & Gijbels (2003) report a robust positive effect from PBL on the skills of students, a non-robust negative effect on the knowledge of students, but a longer retention of the acquired knowledge. In a study comparing a single medical school using PBL with other curricula (Schmidt et al. 2009) positive effects were reported on diagnostic reasoning, communication skills, teamwork, and medical skills. Furthermore graduation rates were higher, study duration shorter and dropout rates lower compared to non-PBL curricula.

Van den Bossche et al. (2004) compared a PBL and a conventional curriculum in business education and concluded that students from the PBL institute score significantly higher on the knowledge test and also tend to do better when required to apply knowledge in the Case-based test.

When separating the knowledge structure in three levels, Gijbels et al. (2005), reported that PBL had the most positive effects when assessment focused on understanding principles that link concepts.

That curriculum wide implementation of PBL enhances deep learning was demonstrated in a review by Dolmans, Loyens, Marcq, & Gijbels (2016).

In a qualitative meta-analysis of meta-analyses Strobel & Van Barneveld (2009) concluded: 'Findings indicate that PBL is superior when it comes to long-term retention, skill development and satisfaction of students and teachers ()' (Strobel & Van Barneveld, 2009, p.44). The meta-analysis by Walker & Leary (2009) including differences across problem types, implementation types, disciplines, and assessment levels resulted in an effect-size of $d_w=.13$ with a lack of homogeneity 'that warrants closer examination of moderating factors'.

Critical remarks about PBL

The most significant criticism regarding PBL was expressed by Kirschner, Sweller & Clark (2006) when qualifying PBL as a minimally guided instructional approach that would ignore the structure of human cognitive architecture, expert-novice differences, and cognitive load. Their critical comments were addressed in three different articles (Schmidt, Loyens, Van Gog & Paas, 2007; Hmelo-Silver, Duncan & Chinn, 2007; Kuhn, 2007) demonstrating that PBL should *not* be qualified as a minimally guided approach but provides extensive scaffolding and guidance that is carefully matched with human cognitive architecture and cognitive load theory.

In their reply to all the commentaries Sweller, Kirschner & Clark (2007) provide two major recommendations: using proper experimental designs when comparing PBL with direct explicit instruction, and to ‘engage in a deeper consideration and explication of instructional “guidance”’.

PBL in Hospitality Management Education

Although PBL has been implemented in many disciplines and at several levels of education (Savery, 2006), research on PBL in hospitality management education seems to be rather scarce (Barrows & Johan, 2008; Barrows & Bosselman, 1999; Dawson & Titz, 2012). Kivela & Kivela (2005) investigated student perceptions of an embedded PBL approach in a hospitality undergraduate program. Results indicated that the PBL-approach had made students more self-directed and less teacher-dependent learners. Chang & Chen (2006) applied PBL in a theoretical science course as part of a culinary art program. Although questions can be raised about the way PBL was operationalised, a positive effect was reported with regard to learning motivation but no difference on learning achievement. Lee (2013) discussed the introduction of PBL in a course in hospitality law, which demonstrated quite some barriers to successful implementation of PBL, both at the student and the teacher side.

Conclusion

In the preceding sections the rationale, theoretical principles, and key components of PBL have been presented. Furthermore, various formats and alternative educational concepts were introduced. Some of the strengths and challenges of implementing PBL as the paradigm for educational configuration were outlined raising many questions for further research and reflection. The studies reported in this critical appraisal were conducted in order to contribute to the PBL paradigm by testing its principles in and extending its practice to the context of hospitality management education.

CONCEPTIONS OF EDUCATION

Constructivism is both a view on knowledge and learning. From an epistemological perspective, constructivism is a way of thinking about the viability of knowledge. Research focuses on the beliefs that students hold about the nature of knowledge and the nature of knowing (Hofer, 2001; 2004). A constructivist view of learning focuses on individual and collective knowledge acquisition and elaboration and has contributed to the development of learner-centered approaches to teaching in which self-directed, contextual and collaborative learning is emphasized (Dolmans, de Grave, Wolfhagen, & Van der Vleuten, 2005). Hospitality management student's epistemological beliefs and conceptions of education were investigated in three studies (Zwaal & Otting, 2007; Otting, Zwaal & Gijsselaers, 2009; Otting, Zwaal, Tempelaar & Gijsselaers, 2010).

In the first study (Zwaal & Otting, 2007) the major issue addressed was the alignment between the institutional conception of education and the students' conceptions of education. The conception of education was divided into three parts: conceptions of knowledge, conceptions of teaching & learning, and conceptions of assessment. Subjects in this study were 324 students enrolled in a four-year hospitality management program. Three instruments were administered to measure students' conceptions of knowledge, conceptions of teaching and learning, and conceptions of assessment (Tenenbaum et al, 2001). Results indicate that the three sets of conceptions seem to fit in the traditional-constructivist dichotomy. Furthermore, it was shown that first-year students score significantly higher than senior students on the traditional scales both with regard to

conception of knowledge and conception of teaching & learning. This difference could potentially be attributed to the impact of a constructivist curriculum on the conceptions of the participants.

The main purpose of the second study (Otting, Zwaal & Gijsselaers, 2009) was to investigate hospitality management students' epistemological beliefs (learning effort, expert knowledge, certainty of knowledge) and their conceptions of teaching and learning (traditional conception, constructivist conception) and the relationship between these beliefs and conceptions. Results show that students with a traditional conception of teaching and learning consider knowledge as more certain and for experts and learning as a matter of drill and practice, while students with a constructivist conception consider knowledge strongly related to learning as a process for understanding and much less as exclusively linked to experts (see figure 1).

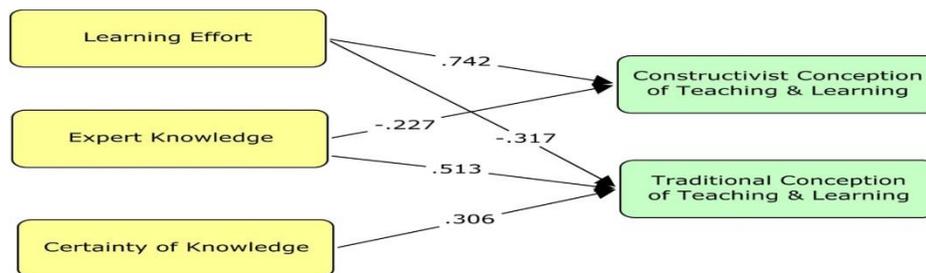


Figure 1. Epistemological beliefs and conceptions of teaching & learning.

The same pattern of results was found in the third study (Otting, Zwaal, Tempelaar & Gijsselaers, 2010) that established the structural relationship among 617 students from nine different bachelor programs, indicating that the majority of the students hold beliefs about knowledge and knowing that are compatible with constructivist conceptions of teaching and learning. Knowledge is not perceived as something that should be transferred from a teacher as the expert to the student, but needs to be constructed in a process of collaborative and self-directed learning, requiring time and effort, and with outcomes that are not considered final and certain but reflecting the students current understanding of a problem area.

The conceptions of assessment were the subject of a study by Zwaal & Otting (2013). It measured the conceptions of assessment held by students and instructors. The conceptions of assessment are considered to be one of the four interrelated sets of conceptions which together constitute the conception of education. The three other sets are the conceptions of (1) knowledge, (2) learning, and (3) instruction. Conceptions of knowledge were measured using an adapted version of Schommer's Epistemic Beliefs Questionnaire (EBQ) (Schommer, 1990; Chan & Elliott, 2004). Conceptions of learning and instruction were measured with the Teaching and Learning Conceptions Questionnaire (TLCQ) developed by Chan and Elliott (2002, 2004). Since no instrument was available to measure conceptions of assessment, an experimental Conceptions of Assessment Scale (CAS) was developed and tested by the authors. Students filled out a 32-item forced-choice version, while instructors filled out a 25-item version in a four-point rating format. On all three instruments a dichotomy was created to distinguish subjects with 'traditional' conceptions from the ones with more 'constructivist' views. Results indicate that students and instructors hold different conceptions of assessment. Students have more traditional conceptions of assessment than instructors. With regard to conceptions of knowledge, students are also more traditional than instructors. The conceptions of teaching and learning show students to be more traditional than instructors too. With respect to the congruency of conceptions of education, students seem to be equally (in)consistent as instructors.

The studies reported in this section contribute in several ways to our knowledge about problem-based hospitality management education.

First of all they show the relevance of measuring and monitoring the alignment between the educational philosophy of an institute and the conceptions of education held by its students and instructors.

Secondly the studies demonstrate that students seem to share the constructivist principles as incorporated in the educational concept of PBL.

Thirdly, the studies indicate that the conception of education is a multifaceted concept and a traditional or constructivist orientation in one domain does not automatically match with the conception of the other facets. Where the conceptions of knowledge and teaching and

learning were structurally related, the traditional or constructivist orientation did not generally match with their conception of assessment.

The fourth contribution of the studies is in showing that the constructivist conception of education as incorporated in PBL are not at odds with the conceptions of students and instructors. Students even tend to replace traditional conceptions for more constructivist ones while participating in a PBL curriculum.

When implementing an educational concept like PBL the conceptions of education are expected to play a crucial role, comparable to the ‘shared values’ in the 7-s model by McKinsey for analysing organizational performance. Next to being shared and supported by staff and students the basic principles of the educational concept should be aligned with the three clusters of educational design: objectives, activities, and assessment (Biggs, 1996).

THE PRACTICE OF PROBLEM-BASED HOSPITALITY MANAGEMENT EDUCATION

In the problem-based hospitality management programme of the Stenden Hotel Management School – the institute where most of the studies were conducted -, students meet twice a week in groups of 12 to discuss and report about problems which have been presented to them. In the first session the problem is analyzed and learning goals are formulated. Self-study is scheduled for the period between the first and second session. In the second session students report on their findings and try to integrate and synthesize the newly acquired information to create a deeper understanding of the principles and mechanisms involved in explaining the problem at hand, in order to be able to manage and master similar problems in the future.

TASKS IN PROBLEM-BASED LEARNING

Since tasks or problems are the stimulus for the learning process in PBL, the quality of tasks is generally considered to be one of the most important elements. In the structural model developed by Schmidt & Gijssels (1990) task, tutor and prior knowledge were shown to be the three most influential factors in PBL. Schmidt (1983) defined a problem as a set of phenomena in need of explanation in terms of underlying principles, processes

and mechanisms. When looking at the role of the problem in PBL two interpretations can be distinguished which could be qualified as the divergent approach or the convergent approach. In the first, the problem is viewed as the stimulus or trigger for learning. In the second, the primary focus is on solving the problem by imitating the way of reasoning as applied by the expert or professional. Problems must build on prior knowledge, stimulate discussion, promote self-directed learning, encourage knowledge integration and transfer, and be relevant for the future profession (Dolmans, Snellen-Balendong, Wolfhagen, & Van der Vleuten, 1997; Dolmans & Snellen-Balendong, 1999).

The study by Otting & Zwaal (2006) contributed to the studies on task design by empirically investigating the theoretical and conceptual criteria suggested in the literature. Six dimensions or task characteristics could be empirically validated: (1) structuredness, (2) prior knowledge, (3) internal coherence, (4) cooperation, (5) personal relevance, and (6) professional relevance. Contrary to expectations, the factor 'complexity' could not be empirically validated as a separate dimension. This might be due to the potential overlap with the structuredness dimension, but further research into that issue is indicated.

When asked to rate the importance and the performance of each task characteristic, students rated 'internal coherence' as high in importance but low in performance, indicating a serious point of improvement. On most dimensions students and instructors agreed on their performance and importance, except for 'personal relevance' which was rated as significantly more important by instructors than by students. Since students and instructors hold different opinions on importance and performance of the six task dimensions we strongly recommend to include both in task construction and evaluation. A task screening committee composed of educational designers and students could use the criteria when developing new tasks or when revising existing ones. If the six criteria would equally apply to different kind of tasks and the different stages in the curriculum would be interesting questions for further research. Those studies could also include the components for designing problems as presented by Hung (2006) in the 3C3R model: content, context, and connection (as the core components) and researching, reflecting, and reasoning (as processing components).

In another study (Otting & Zwaal, 2011) investigated if students with a constructivist or a traditional conception about teaching and learning prefer different types of problems. A questionnaire was used to classify students' conceptions as either constructivist, traditional or mixed. Problems were categorised in a 2 x 2 matrix based on structuredness and authenticity, and were rated on a 10-point scale by a sample of 324 hotel school students. Results show that senior students endorse constructivist conceptions more strongly than first year students, but no significant differences could be detected between constructivists and traditionalists with regard to preference for type of task. Constructivist students did not have a stronger appreciation for authentic tasks, unstructured tasks, or the combination of authentic and unstructured tasks than students with a more traditional conception of education.

Since the first year modules included in the study happened to contain only inauthentic tasks and the selected modules from year 2 & 3 only included authentic tasks, results should be interpreted with care. Nevertheless the study contributes to the development and testing of empirically and theoretically validated guidelines for the construction and evaluation of PBL tasks in three ways. Firstly the task types should be conscientiously designed and distributed over modules and study years. Secondly, when looking at the type of task students prefer, the highest score is for structured inauthentic tasks, which is completely opposite to the general idea that problems in PBL should be authentic and ill-structured. The constructivist students rated the structured and inauthentic problems even higher than the traditionalists. This leads to the third contribution of this study to the research on PBL: it raises quite a few questions for further research regarding the format and function of tasks in PBL. What indicators do students use when assessing the structuredness of a problem? What amount and kind of structure is required to enable students to activate prior knowledge, create interest in the subject, promote constructive teamwork, and motivate them for self-directed learning?

TEAMWORK

Problem-based learning is a form of team-based learning (Sweet & Michaelsen, 2012) and managing both the social dimension and the task dimension (Jaques & Salmon, 2007) is a critical component of the approach (Moust, Bouhuijs, & Schmidt, 2013; Yew, 2009).

In their model of team effectiveness Robbins & Judge (2019) distinguish three sets of drivers: (1) context, including aspects like adequate resources, climate of trust and performance evaluation system; (2) composition, covering elements like groupsize and abilities, personality, diversity of its members; (3) process, including common purpose, conflict management and communication.

The impact of the composition of the tutorial group was studied in Zwaal, Otting, Eringa, & Siehoyono (2005) and in De Kleijn & Zwaal (2014). The purpose of the first study was to investigate how the increased diversity in the student population has impacted on the PBL-process. More specifically, the study focused on the influence of group composition on assessment scores in PBL. Results indicate that culturally heterogeneous PBL-groups outperform culturally homogeneous PBL groups.

Although research has been reported on the relation between learning styles and the perception of PBL (Pungente, Wasan, & Moffet, 2003) and between learning styles and personality profile (Threeton and Walter, 2009), no research has been done linking the three variables in one design. In order to fill that gap a study was initiated to investigate the relationship between learning style, personality profile and perception of PBL. The 9-item learning style inventory by Kolb (1984), the 44-item Big Five Inventory developed by John (1999) and a self-constructed PBL process inventory was administered to a sample of 99 first year hospitality management students. Results showed no significant difference in the appreciation of PBL as an educational method between different learning style groups ($F(3,95)=.849$; $p=.471$) and between students with different dominant personality dimensions ($F(3,82)=1,324$; $p=.272$). Furthermore, no significant relationship occurred between the learning style and the personality profile of the students ($X^2=9.724$; $df=9$; $p=.373$). These results provide some support for the idea that PBL as educational concept can accommodate students with different learning styles or personality profiles. New and

additional questions would be about the optimal student-mix and the impact of personality and learning style on the different steps in the PBL process.

THE SEVEN-STEP PROCEDURE

While working on the PBL-tasks the tutorial group uses a systematic approach called the seven-step procedure (Schmidt, 1983):

Step 1: clarify terms and concepts not readily comprehensible

Step 2: define the problem

Step 3: analyze the problem

Step 4: draw a systematic inventory of the explanations inferred from step 3

Step 5: formulate learning objectives

Step 6: collect additional information outside the group

Step 7: synthesize and test the newly acquired information.

The way students apply and appreciate the seven-step procedure was the topic in three studies conducted at the Stenden Hotel Management School.

In the first study, Zwaal & Otting (2010) addressed two issues: (1) the way tutorial groups tackle their tasks applying the seven step procedure and (2) how tutors coach the groups during PBL meetings. Results indicated that the five PBL groups studied spent between 30-60 minutes on the first steps of the seven step procedure. When asked to rate the quality of executing the different steps, ‘formulating learning objectives’ (step 5), ‘clarify terms and concepts’ (step 1) and ‘draw a systematic inventory’ (step 4) scored lowest. Additionally, tutor interventions were more task-oriented than group focused.

In the second study Zwaal & Otting (2014) investigated how hospitality management students appreciate the role and application of the seven-step procedure in problem-based learning. A survey was developed containing sections about personal characteristics, recall of the seven steps, overall report mark for the procedure, and 30 statements about elements of and experiences with the seven-step procedure. The survey was administered to a sample of 101 first-, second- and third-year hotel school students. Results show a low recall but

positive opinion about the seven-step procedure. Particularly step 4 (conceptualizing), step 6 (self-study between sessions) and step 7 (synthesizing new information) need attention.

In the third study (Zwaal & Otting, 2016) students were asked to rate the importance and performance of each of the seven steps and to indicate how much time they spent on each one of them. Results showed that students consider step 6 (self-study) to be most important and step 1 (clarify difficult words) the least important. Regarding the performance of the different steps, they consider step 2 (define the problem) as best performed and step 4 (conceptualizing) as worst performed. Students indicate to spend an average of 133 minutes on the entire seven step procedure with the highest amount of 42 minutes on step 6.

The contribution of these studies to our understanding of PBL is threefold. Firstly, the studies demonstrate that the way the seven step procedure is executed as a scaffolding tool in PBL leaves room for significant improvement. For instance, when looking at the time spend on step 6 – the period of self-directed learning between two PBL sessions – the reported 42 minutes seems to be completely at odds with the numbers generally reported in the literature, which range between 10 – 15 hours per week (Loyens, Gijbels, Coertjens, Côte, 2013; Moust, Roebertsen, Savelberg, & De Rijk, 2005; Van den Hurk, Wolfhagen, Dolmans, Van der Vleuten, 1998; Wijnen, Loyens, Smeets, Kroeze, Van der Molen, 2017). In an earlier evaluation of all SHMS modules offered in period 2 in academic year 2008-2009 we had obtained an average of 14.7 hours per week. The discrepancy between the time reported in the different studies would warrant further research into the amount and kind of self-study activities of the students.

Secondly, the studies reflect an incomplete internalisation of the PBL principles. The problem is not interpreted as a trigger that opens many routes for learning, but as a problem that should be solved following the seven steps like an algorithm. The approach becomes more convergent (problem-solving) than divergent (problem-based learning). That students consider the self-study stage outside the group as most important and on which they spend most of their time, raises the question about the balance between collaborative and individual learning. If students would feel that individual learning outside the group is

more effective than team-based learning, that could potentially undermine the collaborative nature of PBL. That would even be exacerbated if tutors are more task-oriented and understating the social dimension of collaborative learning.

Thirdly, the studies show that particularly step 4 (conceptualizing), needs attention. In all three studies it was identified as a weakness in the application of the seven step procedure. We tried to improve the execution of step 4 by introducing a specific technique called concept mapping.

CONCEPT MAPPING IN PROBLEM-BASED LEARNING

A concept map is a graphical tool to activate and elaborate on prior knowledge, to support problem solving, promote meaningful learning (Bridges, Corbet & Chan, 2015; Daley & Torre, 2010), conceptual thinking (Loyens, Jones, Mikkers & Van Gog, 2015), to organise and memorise knowledge (Blunt & Karpicke, 2014; Nesbit & Adesope, 2006) and for feedback and assessment (Kassab & Hussain, 2010). Concept mapping was developed by Joseph Novak (1998) who was inspired by the cognitive view on educational psychology from Ausubel (1968).

Visualising the current understanding of a topic or problem is expected to help in activating prior knowledge (step 1-3), to structure potential explanations (step 4), to identify missing links and formulate learning objectives (step 5), and to modify and elaborate the knowledge network when incorporating new information (step 7).

The impact of concept mapping on the process of problem-based learning was the subject of a paper by Zwaal & Otting (2012). The aim of the research was to determine if the use of concept mapping (CM) in a problem-based learning (PBL) curriculum enhances the PBL process, with a particular focus on step 4, where students are expected to draw a systematic inventory of the explanations inferred from analysing the problem. Two separate studies are reported. The first study was conducted with four PBL groups, with two groups using concept mapping. In the second study, three of seven groups were assigned to use concept mapping. All PBL groups were audio- and videotaped. Results show that concept mapping did not affect the time spent on step 4 of the seven-step procedure or lead to more or better

matching learning goals. Nevertheless, when evaluating the PBL session, students working with concept mapping were more satisfied with the execution of step 4, the decision-making process, and the communication within the group. Though indications exist that concept mapping might be a useful tool to enhance the process of PBL (Bridges, Corbet & Chan, 2015), further research is needed, controlling for the impact of the quality of the problems and tutor interventions.

TUTOR INTERVENTIONS

One of the drivers of the PBL process is the quality of tutor interventions (Van Berkel, Scherpbier, Hillen & Van der Vleuten, 2010; Kek & Huijser, 2017; Schmidt & Gijsselaers, 1990; Otting & De Boer, 2012).

In the study by Moust & Schmidt (1998) three variables are used to conceptualize the impact of the tutor on the PBL-process: cognitive congruence, content expertise, and social congruence. A key-concept in their model is cognitive congruency. Cognitive congruency is the ability of the tutor to tune in with the competence level of the students and the skill to apply interventions that match the particular competence level. Two requirements for cognitive congruency are (1) sufficient content expertise and (2) an adequate level of social congruency. Social congruency means that the tutor shows authentic interest in the emotional, motivational, social, and affective aspects of the students.

In a study by Dolmans, Gijsselaers, Moust, De Grave, Wolfhagen, Van der Vleuten (2002) three major trends in research on the tutor in problem-based learning are distinguished. The first trend is about the differential influence of *content expert versus non-content expert* tutors on student achievement. Research shows ambiguous or mixed results. One explanation may be the poor definition of the concept “subject-matter expertise of the tutor”.

The second trend is the *process orientation*. Studies on the quality of interactions in the tutorial group show that expert tutors seem to take a more directive role in the tutorial group. Groups guided by content experts generate twice as many learning issues and spend approximately twice as much self-study time per case. Non-content expert tutors

better maintain the facilitator role and initiate more activities dealing with group dynamics. Student tutors display more cognitively congruent behavior: matching the students' way of thinking and interacting right above the students' level of knowledge. The third trend focuses on the *interaction between process variables and outcome variables*. This leads to studies that investigate the relationship between tutor characteristics and differential contextual variables like: quality of the cases, structure of the PBL courses, link with students' level of prior knowledge, structure of the curriculum and functioning of tutorial groups. When the structure of a course is low and/or students lack prior knowledge or the group is unproductive, the impact of a tutor's expertise on student performance is greater.

A study by Zwaal & Otting (2004) was aimed at the description and analysis of the experiences and expectations that students have of the tutor role in problem-based learning. A sample of 384 students from six different programmes of the Stenden University of Applied Sciences in Leeuwarden was surveyed using an 80-item questionnaire. Results indicate that students do agree that tutors (1) monitor the chairperson, (2) monitor group functioning, (3) use their expertise to help students, (4) ask for relations between subjects, (5) correct wrong lines of reasoning, (6) often refer to the module book, (7) follow tutor instructions, (8) register absentees, (9) arrive on time and (10) cancel sessions at the end of the module. The structure in the items on tutor performance could be summarized by five components: (1) Module expertise, (2) Test preparation, (3) Guidance, (4) Language, (5) Obstructive behaviour. When students were asked to indicate the three most important competencies of a good tutor, the most frequently mentioned answers were (1) sufficient knowledge of the module, (2) steering, (3) timely intervention. These findings seem to match with the concepts of social congruence, content expertise and cognitive congruence as proposed by Moust & Schmidt (1998).

In the study by Assen, Meijers, Zwaal & Poell (2020) tutor beliefs and tutor behaviour was classified as either teacher-oriented or learner-oriented. Results showed that where tutors indicate to hold learner-oriented beliefs, they actually show more teacher-oriented behaviour. Tutors tend to apply a directive style in guiding and to focus more on the content

than on the process. Since PBL is supposed to be student-centered and promoting self-directed learning, the tutor should rather be a supportive facilitator than a directive teacher. Systematic, structural and collective training of tutors is indispensable for maintaining, cultivating and harvesting the potential of PBL.

ASSESSMENT

One of the major challenges in PBL is the design of an assessment method that is aligned with the objectives, activities and educational concept (Biggs, 1996; Schuwirth & Van der Vleuten, 2011; Van der Vleuten & Schuwirth, 2019). Alignment with the principles of PBL would require an assessment procedure that reinforces the key tenets of PBL: contextual, collaborative, constructive, self-directed learning.

Sitting at a desk in a test hall, answering a few dozen multiple-choice items, does not reflect the context of a professional situation, is individual rather than collaborative, is more reproductive than constructive, and often contributes little to learning. This traditional approach of assessment of learning should be replaced by a constructivist approach in which assessment is used as a tool for learning or even as a learning experience in itself (assessment as learning). In the traditional conception of assessment the focus is on summative measurement of acquired factual knowledge at the end of a teacher-centered course, while a more constructivist conception of assessment would focus on providing formative feedback regarding the competence development and the learning process of the students (Boud & Falchikov, 2007; Wiggins, 1998).

A study on the conception of assessment held by students and teachers, indicated that students have a more traditional conception of assessment than teachers (Zwaal & Otting, 2013). They more strongly agree with statements like ‘assessment should indicate whether you passed or failed’ than ‘assessment should provide information on your strengths and weaknesses’ and rather choose ‘assessment should be focused on learning results’ than ‘assessment should be focused on the learning process’.

When thinking about a way to design an assessment procedure that would be more aligned with the principles of PBL we were inspired by the assessment & development centre method (ADCM) as applied in the real world of business and industry, and by the skills-

lab used as one of the assessment tools in the PBL curriculum at Maastricht University. In both the assessment centre and the skills-lab, participants follow a circuit of stations, and at each station they have to perform a particular task demonstrating relevant skills, while being observed by trained assessors.

The use of the assessment & development centre method in a problem-based learning environment was explored in a study by Zwaal & Eringa (2000). Several pilots were conducted with groups of up to 60 participants. Results showed that the ADC method was feasible to apply (constructing exercises, rating scales, training assessors), generated useful and valid output and was appreciated by the participants. The assessment & development centre method appeared to be a promising device for more flexible and adaptive education, focusing on the competency-components of skills and attitudes that industry generally rates as more important than the acquired amount of knowledge. Furthermore ADC's have a good reputation both among psychometricians and the public at large. Most importantly, the method seems to match the criteria for an educative assessment method that supports contextual, constructive, collaborative learning.

More recently a format of assessment for PBL, reflecting the assessment center method, has been implemented when designing a new educational unit on Organisational Behaviour (Zwaal, 2019). By taking the core characteristics of PBL as starting point (Barrows, 1996; Schmidt, Van der Molen, Te Winkel, Wijnen, 2009) and replacing the word 'learning' with 'assessment' the following set of potential criteria occurred:

- Assessment is student-centered;
- Small-group, constructive, collaborative and competence-based assessment;
- A tutor is present as assessor;
- Real world contextualized problems are presented as the trigger for assessment;
- The assessment task enables students to demonstrate their mastery of required competences;
- The assessment session might raise issues and interest for further self-directed learning.

The approach that was implemented consists of a final PBL session, called the assessment session (or: assessment), in which each PBL-group has 2 hours to produce a Case Paper covering a proper description, diagnosis and feasible solutions to a real world OB problem

situated in the hospitality industry. Results showed that students appreciate the educational value of the approach and consider it enhances their conceptual skills and competence in contributing to constructive teamwork. Since this way of summative team performance assessment requires students to manage and monitor both the task as well as the social dimension of constructive and collaborative teamwork it could be a viable solution when designing assessment for PBL (Boud & Falchikov, 2007).

FUTURE DIRECTIONS: FROM PBL TO DESIGN-BASED EDUCATION

Innovation in hospitality management education

Although the hotel management school has been a pioneer in implementing PBL some signs of erosion have occurred (Moust, Van Berkel, Schmidt, 2005; De Boer & Otting, 2011; Zwaal & Otting, 2015;) and the concept has even been criticized for offering too little guidance and instruction (Kirschner, Sweller, Clark, 2006). In a recent book on innovation in hospitality education (Oskam, Dekker, Wiegerink, 2018) it is concluded that three major drivers for change in hospitality education are (1) the evolution of the hospitality industry due to technology and globalization, (2) the position of hotel schools within the higher educational system, and (3) educational innovation in general. In his contribution to the book Catrett (2018) suggest to replace and integrate the two existing paradigms, the vocational/artisanal paradigm and the management science/business paradigm, with a third paradigm which is called Artistic/design-based:

It is reasonable to believe that hospitality education must now enter a third phase which, while not completely abandoning practice-based vocational or elements of management science, must at the very least embrace a substantial new aspect based in arts approaches and design (Catrett, 2018, p.30).

When the two Universities of Applied Sciences in Leeuwarden decided to merge in 2017, they agreed to introduce a new educational concept called Design Based Education (DBE). This educational concept was generated as covering and integrating the strengths of both educational institutes, developments in the educational sciences and creating ways for

continuing educational innovation. Design Based Education is based on social constructivist, contextual, self-regulated and collaborative learning and incorporates five integrated aspects: (1) Design thinking; (2) International & Intercultural; (3) Multidisciplinary collaboration; (4) Personal leadership; (5) Sustainable education. In workshops (ateliers), students will work on real world innovative design-challenges for industry partners, supported by mentors and resources. The cyclic method students are expected to follow consists of the following six steps:

1. Conduct practice-based research;
2. Determine the question, based on knowledge;
3. Generate ideas;
4. Create a design or prototype;
5. Apply the design or prototype;
6. Research the impact and effects.

Students will be offered a flexible, international, digital and physical environment for effective high quality world-wise education (NHL/Stenden, 2019).

When comparing DBE with PBL some similarities and differences are noticeable. The principles of contextual, constructive, collaborative and self-directed learning are maintained and possibly even strengthened by using real world problems and action orientation (Savin-Baden, 2014; Walker, Leary, Hmelo-Silver, Ertmer, 2015). Whether the industry is willing and ready to participate in this process of trying and testing of prototypes is a potential risk (Wilson-Wunsch, 2016). In PBL a problem is presented as the starting point or trigger for learning and not primarily as an issue that should be solved. A learning orientation might be something different than an outcome orientation.

When comparing the 7-steps of PBL with the 6-steps of DBE, the PBL-cycle seems more focused on understanding and developing a conceptual network, while the DBE approach is about interventions and testing their impact.

Although the operational details of DBE are not fully clear yet, the 10-12 person PBL-teams are expected to be replaced by groups of double that size. The strategic plan

(NHL/Stenden, 2019) refers to groups of 24 students and some working documents mention so called home-groups of 50 students.

In DBE the tutor role is replaced by three new roles: (1) the Designer, responsible for one or more ‘ateliers’; (2) the Activator, managing a ‘home-group’; (3) the Inspirator, offering resources to students. The consequences of these new roles for job design and human resource management will need to be worked out in further detail.

When looking back at the experiences with PBL a couple of lessons can be learnt when building and implementing this new educational concept.

The first and major challenge is on the conceptual level, i.e. to create and cultivate a shared understanding of the concept of education (knowledge, teaching, learning, assessment) among students and staff. In his famous model of constructive alignment, Biggs (1996) indicated that *Outcomes*, *Activities*, and *Assessment* should be aligned with each other in order to deliver high quality education. I would like to add the *Educational Concept* as the fourth component to the model, since the educational concept should be the driver, feeding into all other components.

Creating a shared understanding and further operationalisation of the educational concept requires a process of collaborative learning and continuous training of tutors, supported by strong educational leadership and design-based educational research. A very similar set of requirements is listed by Kek & Huijser (2017) when imagining what they call an ‘agile PBL ecology for learning’. They use an adapted version of Bronfenbrenner’s ecological model to present a learning environment in which micro-, meso, exo- and macro system are connected and mutually interacting layers. After presenting the characteristics of the next generation of learners and the growing role of technology and digitalisation, Kek & Huijser (2017) focus on three specific elements of a PBL curriculum: learning outcomes, authentic interdisciplinary problems, and assessment. They suggest to link the learning outcomes to employability and 21st century skills. In the new DBE curriculum of the hotel school this advice has been followed, since all 25 learning outcomes are clustered according to the 21st century skills framework. With Kek & Huijser I do consider the quality of the problems – in combination with the quality of the teamwork - to be one of the most critical factors for the success of PBL. The construction of authentic

interdisciplinary problems is a difficult process. Real-world problems are generally ill-structured and would require students and tutors to deal with several perspectives and multiple subject areas when addressing it. Interdisciplinary problems require collaborative learning by both students and teachers. Our experiences with PBL have demonstrated that teachers might be uncomfortable with this shift in orientation, if not in what they say than in what they do. In the new DBE curriculum, problems will be replaced by so-called 'design challenges'. As these design challenges are executed for and tested within real world companies authenticity will probably be perceived as high, although you could ask how often hospitality companies have external teams of five students analysing and (re)designing their business processes for them. The 'design challenges' are also expected to appeal to the action-oriented and pragmatic attitude of many hotel school students, but whether it will equally enhance their conceptual competencies is an open question. When design challenges would exclusively or predominantly focus on solving practical business management projects there is the risk of succumbing to what Lashley termed the 'tyranny of relevance' (Lashley, 2004). He pleads for integrating arts and social sciences in a curriculum focused on the study *of* hospitality rather than *for* hospitality (Lashley, 2018a; 2018b; 2017). If the 'ateliers' and 'design challenges' will allow for this broader and reflective perspective or cultivate a narrow and functional approach to hospitality management needs careful consideration when developing the new curriculum.

Another aspect of the educational configuration that needs to be addressed before starting the new hotel school curriculum in February 2020 is the issue of assessment. In the original PBL programme, assessment was based on three components per module: (1) active participation; (2) a module assignment; (3) an end-of-module test. In a flexible DBE curriculum assessment will be focused on the 25 learning outcomes that have been collectively agreed by all Dutch higher hotel schools. When students would be allowed to work on any mix of learning outcomes, using multiple ways of demonstrating their mastery, and apply for assessment at any moment, that would generate a tremendous challenge to validly and reliably measure, manage and monitor their progress. Working with design-challenges particularly raises the question of domain specificity in testing. Are students who work on project X for company Y sufficiently equipped to address similar

issues in a different setting? Have they mastered the structural principles in a subject area or have they managed one specific project? What would qualify as sufficient and valid evidence for mastering a particular learning outcome? The issue of assessing active participation in PBL or DBE sessions and monitoring performance when working on group assignments will remain an issue of debate and concern.

An essential component to accompany the implementation and evaluation of an educational concept is dedicated educational research. Allocating resources and expertise to measure, monitor and support the development and effectiveness of the educational concept and its operationalisation is indispensable for the process of collaborative learning within the institution and for contributing to a better understanding and more effective configuration of hospitality management education. Several topics as discussed in the studies on PBL seem equally relevant for further research when implementing DBE: What are the critical characteristics and criteria for a design challenge? How to promote constructive teamwork? How to make teachers behave in a student-centered way? What tools and techniques are most conducive for educative assessment? And last but not least: How to create and operate a curriculum that is promoting constructive, contextual, collaborative, self-directed learning for the 21st century, and beyond.

CONTRIBUTION TO KNOWLEDGE, IMPLICATIONS FOR PRACTICE AND RECOMMENDATIONS FOR FURTHER RESEARCH AND DEVELOPMENT

Contribution to the knowledge about and the practice of PBL

The published works submitted for the PhD contribute to knowledge in three different areas: first and foremost to the PBL paradigm, both on a conceptual level (conceptions of education) and on the operational level (task, seven steps, teamwork, tutor, assessment), secondly to the field of innovation in hospitality management education and thirdly to design-based research.

The studies contribute to the knowledge of the PBL paradigm by showing that constructive, contextual, collaborative and self-directed learning that have been shown to work for

medical education also work for an applied and professional field as hospitality management education. An important prerequisite for the educational concept to succeed is a shared understanding of its principles, a continuous debate about its operationalisation, and empirical research to evaluate its implementation and effectiveness. The published works and its contribution to knowledge show that problem-based learning when compared to other educational concepts was recognised as a constructivist approach to education and as a concept with an impact on the epistemological beliefs and conceptions of teaching and learning of both students and lecturers. The studies showed the relevance of measuring and monitoring the alignment between the educational philosophy of an institute and the conception of education held by its students and teachers. One key contribution to knowledge was the importance of an entire curriculum approach for PBL to be successful. If part of the team consider PBL to be the weekly tutorials while it is supposed to be an approach to the entire curriculum, and when different concepts like CBL and blended-learning are being used next to PBL, erosion of the concept is likely to set in. If the concept is not continuously cultivated, monitored and managed it risks losing its strength or even to be replaced by traditional teacher-centered education. The process of collective learning about PBL that was very strong in the pioneering stage of the hotel school is indispensable for cultivating the constructivist conception of hospitality management education. The second key contribution was that this process of collective learning needs to be supported and informed by sound educational research coordinated by an authoritative center on educational research and development.

Two more specific contributions to the process of PBL are the introduction of concept mapping as the operationalization of step 4 of the seven step procedure and the development of a method of assessment for PBL that is aligned with the principles of PBL.

Implications for Practice

Implementing the principles of contextual, constructive, collaborative and self-directed learning requires a shared vision, a continuous debate and dialogue, informed and supported by sound educational research. Notwithstanding its expected benefits, educational innovation and change

will generate resistance and require educational leadership and maintenance to succeed. Moving from a testing culture to an assessment culture, replacing lectures with tutorials, and focussing on competencies instead of just knowledge, require a substantial change in mindset from staff and students alike. Neither the vocational model nor the business school model seem to be fitting the profile of the students and the hospitality industry. Taking into account the developments in the educational sciences, characteristics of the student population and trends in the hospitality industry, a new concept was recently introduced, called Design Based Education (DBE). When developing this new concept as the next stage of PBL, some lessons can be learned from the published works and the contribution to the field of PBL and hospitality management education about the practice of PBL. Tasks need to be carefully constructed, tutors need training in translating their learned-oriented beliefs in equivalent behaviour, and guidelines and scaffolds should promote adequate investment of self-study time and enhance their conceptual thinking and problem solving competencies. Furthermore the assessment mix should be aligned with the principles of constructivist education and team-based learning. Although the operationalisation of PBL is open for innovation and experimentation on issues like the construction of tasks, the proper mix between self-study versus contact hours, flexibility versus fixed components, individual or teamwork and the relative share of theory and practice in the curriculum, the principles and theoretical foundations of PBL offer a solid framework for an effective educational configuration.

The contribution of the published works to innovation in hospitality management education is in cultivating a constructivist conception of education. Educating students in a way that prepares them to address real-world problems (context) in collaboration with others in a constructive (creative and knowledgeable) way while developing an attitude of self-directed lifelong learning is at the best interests of all parties involved: students, education and industry. This is considered to be a valid rationale for implementing problem-based learning in hospitality education.

Recommendations for further research and development

Many of the studies submitted in the portfolio of Published Works are based on cross-sectional quantitative survey research. In future research this approach could be extended

by using a longitudinal design and by including qualitative methods like interviews to corroborate the survey findings. Longitudinal studies could provide more insight in how epistemological beliefs and conceptions about education develop over the four years of the program and beyond. Furthermore it would be interesting to investigate how alumni evaluate the value of PBL in their working careers. Another interesting line of research would be to compare PBL-graduates with non-PBL graduates, although the comparison of curricula is considered hard to interpret due to many disturbing variables. Further research into what students actually do in step 6 (self-study) would probably require more qualitative approaches like observations and interviews.

The research task of Universities of Applied Sciences is relatively new and the culture and infrastructure for research is substantially weaker than at the regular academic universities. As indicated at several places above, I would strongly recommend the installation of a Center of Educational Research & Development that should initiate and coordinate research programs on subjects like: ‘What do students actually do in step 6?’ or: ‘How do lecturers calculate the study load of their unit?’ or: ‘How do alumni apply and appreciate the principles of PBL in their work?’.

As a lecturer on research and statistics it is my objective to combine my contributions to educational development with the ambition to develop the concept of ‘Professional Research’ as a distinctive approach for professional universities. Professional research is a form of applied research aimed at choosing, implementing and evaluating interventions for improving business performance. Following a pretest-intervention-posttest design, teams of students are expected to help hospitality companies make structural and significant enhancements on key business processes. The interventions can target any (combination of) the quintessential hospitality management areas: (F&B and RD) Operations, Human Resources, Marketing & Sales, Finance, Technology. Having teams of students conduct research projects in and for hospitality companies will strengthen the link between education and industry by providing authentic real-world task that will promote transfer of training and the transfer of knowledge. The close link between doing research and learning is also reflected in the seven step procedure of PBL and the different stages in design thinking. Since the characteristics of professional research are very similar to

those of design-based research, the connection to Design Based Education is obvious. Design-based research (DBR) can help industry improve performance, support the learning process of students, and be used to optimize the educational concept of the institute. As Dolmans (2019) stated: () DBR can help us gain better insight into why PBL, with certain characteristics, preferably based on theory, might work in a specific context with particular goals in mind.

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Annex 1: Published Works

1. Zwaal, W., & Otting, H. (2006). Hospitality management students' conceptions of education. *Tourism and Hospitality Research*, 7(3/4), 256-268.
2. Otting, H., & Zwaal, W. (2006). Critical task characteristics in problem-based learning. *Industry & Higher Education*, 20(5), 347-357.
3. Otting, H., & Zwaal, W. (2007). The identification of constructivist pedagogy in different learning environments. In M.K. McCuddy, H. van den Bosch, Wm. B. Martz, A. V. Matveev, & K. O. Morse (Eds.), *The Challenges of Educating People in a Challenging World* (pp. 171-196). Dordrecht: Springer.
4. Otting, H., Zwaal, W., & Gijsselaers, W. (2009). International Hospitality Management students' epistemological beliefs and conceptions of teaching and learning. *Journal of Hospitality & Tourism Education*, 21(3), 44-53.
5. Otting, H., Zwaal, W., Tempelaar, C., & Gijsselaers, W. (2010). The structural relationship between students' epistemological beliefs and conceptions of teaching and learning. *Studies in Higher Education*, 35(7), 741-760.
6. Zwaal, W., & Otting, H. (2010). The process of problem-based hospitality management education. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 9(2), 17-30.
7. Otting, H., & Zwaal, W. (2011). Hospitality management students' conceptions about teaching and learning and their evaluation of tasks in problem-based learning. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 10(1), 4-12.
8. Zwaal, W., & Otting, H. (2012). The impact of concept mapping on the process of problem-based learning. *Interdisciplinary Journal of Problem-based Learning*, 6(1), 104-128.
9. Zwaal, W., & Otting, H. (2013). A traditional versus a constructivist conception of assessment. *Research in Hospitality Management*, 2(1), 29-38.
10. Zwaal, W., & Otting, H. (2013). The attitude of hotel school students toward hospitality finance. *The Journal of Hospitality Financial Management*, 21(2), 115-122.
11. Zwaal, W., & Otting, H. (2014). Student opinions about the seven-step procedure in problem-based hospitality management education. *Journal of Problem-based Learning in Higher Education*, 2(1), 18-28.
12. Kleijn, A. de, & Zwaal, W. (2014). The relation between learning style, personality and the perception of problem-based learning. In: Papathanassis, A., Breitner, M.H. & De Groot, A. (Eds.). *Cruise Tourism & Innovation*. Berlin: Logos Verlag.

13. Zwaal, W., & Otting, H. (2015). Aligning principles and practice in problem-based hospitality management education. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 16, 22-29.
14. Zwaal, W., & Otting, H. (2016). Performance of the seven-step procedure in problem-based hospitality management education. *The Journal of Problem-Based Learning in Higher Education*, 4(1), 1-15.
15. Zwaal, W. (2019). Assessment for problem-based learning. *Research in Hospitality Management*, 9(2), 77-82.
16. Assen, J. H. E., Meijers, F., Zwaal, W., & Poell, R. F. (2020). Collective learning, teacher beliefs and teaching behaviour in management and social-educational university programmes. *Journal of Vocational Education & Training*, 72(1), 1-22.

Annex 2: Contribution statements

Contribution statement Dr. Hans Otting:

The generic structure of the collaboration can be described as follows.

First of all we both share a passion for higher education in general and Problem-Based Learning (PBL) in particular. Hans Otting with a background in pedagogy and educational management and Wichard trained as psychologist and educational researcher have joined forces in a shared research programme about the philosophy, principles and practice of PBL.

The ideas for a particular study resulted from our continuous dialogue about the theory and practice of problem-based hospitality management education, fueled by practical experiences as lecturer, tutor, manager or trainer and reading, talking and thinking about the topic.

Considering the organic and close cooperation between us it is almost impossible to exactly reconstruct the origin of every sentence or section of the papers, we can say that roughly speaking Hans would often take the lead in working on the theoretical framework (and the Introduction and references of the paper), while Wichard would generally focus on the instrumentation and data collection (the Method section). Data analysis was a joint effort, where Hans specialized in structural equation modelling (SEM) and Wichard on most other statistical analyses with SPSS. The Discussion section was the result of a few rounds of reviewing, editing, expanding and rejecting of mutual text proposals.

The position of first or second author has never been challenged and represents the relative contribution of the authors and their areas of interest or expertise. For instance the studies about epistemological beliefs are more closely linked to Hans, while Wichard has more affinity with studies about assessment.

Every paper was published with full consent of both authors.

Dr. J. M. Otting

Contribution statement Dr. Hanneke Assen:

My co-author Wichard Zwaal has made a substantial contribution to the conceptual model, the analyses and interpretation of the data, and in producing and publication of the paper.

With regard to the conceptual model Wichard contributed to the development of the classification of teaching categories by suggesting a 2-dimensional model with two axes and four quadrants.

As a specialist in statistics, SPSS and applied data analysis, Wichard has made substantial contributions to most of the data analyses. Whenever required, additional analyses were conducted, if necessary even on very short notice. Relevant tables were produced and adapted in a professional way. All analyses were explained and discussed and options and limitations of statistical techniques have been outlined whenever needed. We have had extensive discussions about the classification of subjects, the use of profiles and about the measurement of agreement between beliefs and behaviour. Finally, Wichard has played an active role in the process of writing, reviewing and editing of the paper. We discussed the choice of an appropriate journal and on the best way to respond to reviewer feedback. Submitting and revising the paper has been a challenging experience but ultimately resulted in a publication based on all our joined efforts.

Although very difficult if not impossible to exactly quantify, I would say his contribution to the project and the paper has been at least 25% and possibly even slightly more.

Dr. J.H.E. Assen

Annex 3: Journal details for Published Works

| Journal | SJR score | Review procedure | Publication |
|--|-------------|------------------|--|
| Tourism and Hospitality Research | 0.688 Q2 | Peer reviewed | Zwaal, W. & Otting, H. (2006). Hospitality management students' conceptions of education. 7: 3/4, 256-268. |
| Industry & Higher Education | 0.205 Q3 | Peer reviewed | Otting, H. & Zwaal, W. (2006). Critical task characteristics in problem-based learning. 20:5, 347-357. |
| Journal of Hospitality & Tourism Education | 0.393 Q3 | Peer reviewed | Otting, H., Zwaal, W. & Gijssels, W. (2009). International Hospitality Management students' epistemological beliefs and conceptions of teaching and learning. 21:3, 44-53. |
| Studies in Higher Education | 1.888 Q1 | Peer reviewed | Otting, H., Zwaal, W., Tempelaar, C., Gijssels, W. (2010). The structural relationship between students' epistemological beliefs and conceptions of teaching and learning. 35: 7, 741-760. |
| Journal of Hospitality, Leisure, Sport & Tourism Education | 0.578 Q2 | Peer reviewed | Zwaal, W. & Otting, H. (2010). The process of problem-based hospitality management education. 9:2, 17-30. |
| | | Peer reviewed | Otting, H. & Zwaal, W. (2011). Hospitality management students' conceptions about teaching and learning and their evaluation of tasks in problem-based learning. 10:1, 4-12. |
| | | Peer reviewed | Zwaal, W. & Otting, H. (2015). Aligning principles and practice in problem-based hospitality management education. Vol. 16, 22-29. |
| Interdisciplinary Journal of Problem-based Learning | 0.364 Q2 | Peer reviewed | Zwaal, W. & Otting, H. (2012). The Impact of Concept Mapping on the Process of Problem-based Learning. 6:1, 104-128. |
| Journal of Problem-based Learning in Higher Education | - | Peer reviewed | Zwaal, W. & Otting, H. (2014). Student Opinions about the Seven-step Procedure in Problem-based Hospitality Management Education. 2:1, 18-28. |
| | | Peer reviewed | Zwaal, W. & Otting, H. (2016). Performance of the Seven-step Procedure in Problem-based Hospitality Management Education. doi:10.5278/ojs.jpblhe.v0i0.1173. |
| The Journal of Hospitality Financial Management | 0.411 Q3 | Peer reviewed | Zwaal, W. & Otting, H. (2013). The Attitude of Hotel School Students Toward Hospitality Finance. 21: 2, 115-122. |
| Journal of Vocational | 0.363 Q3 | Peer reviewed | Hanneke Assen, H., Zwaal, W., Meijers, F., Poell, R. (2019). Collective Learning, Teacher Beliefs and Teaching Behaviour |

| | | | |
|------------------------------------|---|---------------|--|
| Education & Training | | | in Management and Social-Educational University Programmes. doi: 10.1080/13636820.2019.1578817. |
| Research in Hospitality Management | - | Peer reviewed | Zwaal, W. & Otting, H. (2013). A traditional versus a constructivist conception of assessment. 2:1, 29-38. |
| | | Peer reviewed | Zwaal, W. (2019). Assessment for PBL. 9:2, 77-82. |