The development of project management competencies

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Abstract
The present study examines the influence of project-oriented learning on the perceived relevance and development of project-management-specific competences. Using a standardised questionnaire, this influence was measured before and after a project-oriented course in order to examine possible developments. A total of 59 Bachelor students took part in the survey. The results show that project-oriented learning is particularly suitable and valuable for the development of project management competencies. In particular, personal and social as well as technical competences are strongly developed and trained in terms of both, perceived relevance and perceived level of performance. On the other hand, a relatively small influence can be observed in relation to context competences.

Keywords
project-oriented learning, project management, competence perception, competence development

1 Introduction

1.1 Importance of projects and project management
Companies are under increasing pressure to innovate and change in terms of diversity and speed (Pfetzing & Rhode, 2009). In order to be able to deal with this situation, project work is gaining in importance due to the relatively simple initiation and high adaptability (Becker & Hofmann, 2010). It is estimated that employees spend a significant part of their working time in project teams (Heyse & Erpenbeck, 2009). The increase and intensification of projects make effective and efficient project management a critical success factor and consequently an essential key competence (Jungmann, Kühn & Nimsch, 2010). The integration of projects and project management in university teaching to prepare for relevant technical and interdisciplinary prerequisites and challenges is therefore of great importance in the sense of a well-founded education and particularly valuable concerning a practical, problem-oriented and interdisciplinary orientation of study courses. The possibility of combining subject-related and interdisciplinary learning as well as creating an active and student-centred learning environment can also contribute to the quality of study programs (Daum & Schneider, 2006).

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1.2 Competencies in project management

A project is new, goal-oriented, budget and organisationally delimited, interdisciplinary and highly relevant for the participating organisational units (Patzak & Rattay, 2014). DIN 69901-5 describes a project as an enterprise which is mainly characterised by the uniqueness of the conditions in their entirety and project management as the entirety of management tasks, organization and techniques for the execution of a project (DIN, 2009). Project management includes the planning, monitoring and control of all aspects of a project as well as the management of the project participants in order to achieve the project goals (DIN, 2009). It requires a wide range of specialist and interdisciplinary skills. Associations such as the "Project Management Austria" (PMA), the "International Project Management Association" (IPMA) or the "Project Management Institute" (PMI) develop standards for defining quality and mapping these competencies. Various models and approaches exist for different problems, such as the ICB (IPMA Competence Baseline) or the PM BOK (Project Management Body of Knowledge), which form the basis for standards-based qualification and certification (Jungmann, Kühn & Nimsch, 2010; PMA, 2015). The competencies can be subdivided into technical/methodological competencies, social competencies, decision-making competencies and application competencies on the one hand, and into project contexts such as the handling of strategies or values, personal/social issues and technical skills on the other (Patzak & Rattay, 2014; PMA, 2015).

1.3 Project-oriented learning in higher education

The increasing importance of projects and the associated increased demand for qualified persons lead to the necessity of imparting the necessary project management competences (Stöhler, Förster & Brehm 2018). Project management, which is represented in various forms, is particularly widespread at universities of applied sciences (Stöhler, 2017). This applies both at Bachelor and Master level, while the focus shifts from practice-oriented to research-oriented projects. In the curricula, project work is often combined with other courses in order to implement and consolidate the theoretical contents and to expand practical specialist knowledge and project-management-specific competences (Stöhler, 2018). Larger projects are regularly accompanied by special project management courses and smaller projects by others, not explicitly project-management-specific courses.

Project teaching and project-oriented learning are particular forms of teaching geared to work in projects. Project teaching is characterised by several characteristic features, such as situational reference, orientation to the interests of the participants or interdisciplinarity (Gudjons, 1984). It is often referred to as a non-existent ideal, especially since the presumed fulfilment of all characteristics is hardly possible (Hänsel, 1988). If characteristics are not fully met due to organisational or other restrictions, this is referred to as project-oriented teaching or project-oriented learning (Gudjons, 1988). The term "project-oriented learning" is much more realistic and widespread in view of the strict requirements for adherence to all the characteristic features of project teaching. The present article, therefore, speaks of project-oriented learning.

The spread of project management is increasing at universities and focuses on a subfield of the respective discipline (e.g. project management in economics) or a concrete field of application (e.g. project management for events) (Hachmeister, 2017). The integration of project management and project-oriented courses in the curriculum supports professional qualification and enables interdisciplinary forms of teaching and learning. While specialist and methodological competencies, such as cost planning, procurement or management of stakeholder interests, can in part also be taught using other course types and methods, the acquisition and expansion of project-specific social and decision-making competencies, in particular, require the integration of project management or project-oriented learning into training courses.

1.4 Research objective

In view of the increasing importance of projects and the implementation of project management in higher education, this contribution aims to evaluate project-oriented learning and its influence on the relevant competencies in project management. Both the development of the perceived relevance of competences and the perceived development of competences over time are examined. The following research questions arises:

How does project-oriented learning influence the perceived relevance of *project-management-specific competences?*

How does project-oriented learning influence the perceived development *of project-management-specific competencies?*

Based on the results, this article will also present recommendations for action, challenges and development opportunities concerning project-oriented learning and, in particular, contribute to the critical discussion and further development of the didactic concept.

First, the theoretical basis concerning project management-specific competencies is discussed. Then the methodology and procedure are presented. This is followed by the evaluation of the data and the presentation of the results. In the last point, these results are discussed, development opportunities and challenges are presented, and recommendations for action are derived.

2 Empirical examination

2.1 Theoretical basis

Competences are characterised by the fact that their mastery can be described at different levels of requirements, difficulty or complexity (Schaper et al., 2012). Competences are context-specific cognitive performance dispositions that relate functionally to situations and requirements in specific domains (Klieme & Leutner, 2006).

The ICB 4 (Individual Competence Baseline) of the IPMA (International Project Management Association) and the PMA (Project Management Austria) is used as the theoretical framework for the investigation of project-management-specific competencies. The "Eye of Competence" classifies individual competence elements into three areas: context competences ("Perspective"), personal and social competences ("People") and technical competences ("Practice") (IPMA, 2015).
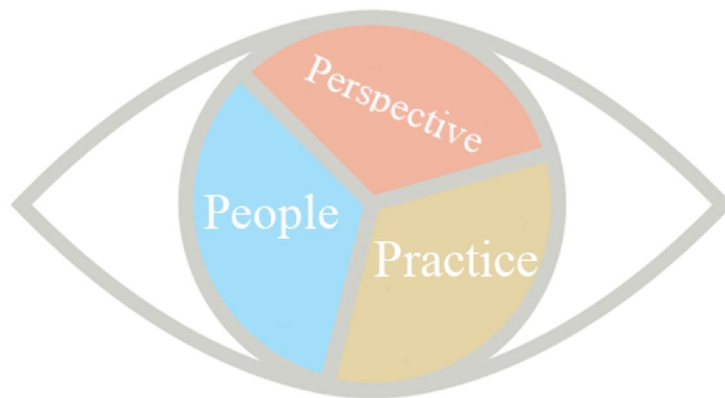

Fig. 1: ICB 4 "Eye of competence" (IPMA, 2015)

The "context" competence elements comprise all methods, instruments and techniques through which individuals can interact with their environment. This is essential because projects are driven, supported and determined by external factors and therefore, the understanding and handling of organisational, political and social influences are critical for successful project implementation. Besides, the context competence elements capture the rationale that drives people, organisations and societies to initiate and implement projects (IPMA, 2015).

"Personal and social" competence elements include attributes that an individual needs in order to successfully participate in or lead projects. The list of personal and social competencies begins with the ability to reflect on oneself, includes, in particular, social, communicative and interactive competence elements and ends with the ability to successfully carry out agreed tasks in a result-oriented manner and terms of stakeholder satisfaction (IPMA, 2015).

The "technical competence elements" consist of specific methods, tools and techniques that are essential for participation in projects and their implementation and management.

The following table describes the individual competence elements of the three areas:

Context Competence ("Perspective")	
Strategy	Understanding strategies, visions and missions and aligning project management with them
Governance, structures and processes	Coordinate projects with the rules of the organisation and the organisational processes
Compliance, standards and regulations	Observe legal regulations and other regulations
Power and Interests	Recognise power potentials, influence possibilities and interests of all persons involved and use them for the benefit of the project.
Culture and values	Recognising different cultures and values and integrating them in project management
Personal and Social Competence ("People")	
Self-reflection and self-management	Understand and reflect on one's behaviour and influence in the project; Set personal goals and review progress.
Personal integrity and reliability	Clear, consistent, reliable and responsible behaviour in project management
Personal Communication	Communicate effectively and efficiently in project management
Relationships and Commitment	Building personal relationships and ensuring good collaboration
Leadership	Lead people according to the situation and in an exemplary manner
Teamwork	Develop efficient teams and recognise group dynamics
Conflicts and crises	Recognising and managing conflicts and crises
Versatility	Promoting creativity, versatility and innovation
Negotiations	Negotiate according to the situation in order to reach satisfactory agreements
Results orientation	Focus on goals and results
Technical competence ("Practice")	

Project design	Know and integrate project goals, resources and stakeholders
Requirements and goals	Identify and integrate stakeholder expectations and requirements
Scope of services and delivery objects	Estimate the content and scope of the project and understand and control the scope of services
Schedule and dates	Planning, organising and coordinating project schedules
Organisation, information and documentation	Design and manage projects as a separate organisation from the parent organisation and collect and document information.
Quality	Identifying and ensuring the required quality
Costs and financing	Planning, securing and monitoring project costs and financing
Resources	Planning, securing and distributing resources
Procurement	Procure resources effectively and efficiently
Planning and control	Planning, coordination, management and controlling of the entire project management
Opportunities and risks	Identify and manage opportunities and risks
Stakeholders	Understanding and managing the social environment of the project
Change and Transformation	Be able to deal with changes in the project management in a suitable way

Table 1: Areas of competence, competence elements and explanation

The unique feature of ICB 4 is that competencies are not treated concerning specific roles (e.g. project leader), but rather in relation to the domain (persons involved in project management) since roles and role designations can differ in terms of industry, orientation and language (IPMA, 2015). By means of domain orientation, the consideration and integration of different roles in the appropriate areas of competence are made possible (IPMA, 2015). As a generic model, there is a general validity for all sectors and industries, and although individual competencies may differ in their presence depending on the type and scope of the project, all competencies are relevant for each project (IPMA, 2015).

2.2 Methodology and approach

2.2.1 Context
The surveys were carried out in a course on "Strategic Business Management" as part of the Bachelor's programme in "Business, Health and Sports Tourism". This event consists of an introductory lecture as well as project-like processing of real tasks with external clients. These are processed in teams of 4-6 persons within 3 months.

2.2.2 Study design
A standardised survey was conducted to ascertain the perceived relevance of project-management-specific competences and to assess how well these are developed among the participants.

In the survey, the perceived relevance of all competence elements mentioned in ICB 4 (see Fig. 2) was measured using six-level Likert scales from "completely irrelevant" to "very high relevance". Finally, the participants were asked how well they assessed themselves concerning the

individual competence elements according to ICB 4. Again, a six-level Likert scale (from "no competence" to "high competence") was used for measurement. The survey of age, gender and the duration of the participants' studies to date were supplemented.

In order to investigate developments and changes, the standardised survey was conducted once at the beginning of the course in March 2019 and once at the end of the course at the end of May 2019. The survey was carried out in paper form on the premises of the university.

2.2.3 Importance performance analysis (IPA)

An Importance Performance Analysis (IPA) was performed to evaluate and interpret the data. This is an analytical procedure in which the two survey dimensions of relevant success factors, namely significance (Importance) and performance (Performance), are evaluated and compared (Martilla & James, 1977). In this way, the IPA not only considers the performance of an attribute but also its significance as a decisive factor and includes it in the analysis process (Silva & Fernandes, 2010). The combination of importance and performance leads to positioning and classification in one of four quadrants (see Fig. 2). Quadrant 1 contains all factors with the highest development priority. Factors in quadrant 2 are highly valued in terms of both significance and performance. Quadrant 3 contains less essential success factors, which are also low in terms of performance. Quadrant 4, on the other hand, contains less important but possibly overfulfilled factors. Based on the respective positioning, conclusions and recommendations for action can be derived (Feistel, 2008).

		low	high
importance	high	**Quadrant 1: "Concentrate Here"** These factors are considered to be particularly important. However, the level of performance is low. Improvement efforts and development priorities should be concentrated here.	**Quadrant 2: "Keep up the good work"** These factors are considered to be very important. The level of performance is high. The level should be maintained that way.
	low	**Quadrant 3: "Lower Priority"** These factors are considered to be less important. The level of performance is also low. Only limited resources should be used for development and improvement.	**Quadrant 4: "Possible Overkill"** These factors are considered less important, but the level of performance is relatively high. There is a risk of wasting resources.
		low	high
		performance	

Fig. 2: Quadrants of the IPA (Tzeng & Chang, 2011)

The origin of the IPA lies in the field of marketing, where it is primarily used to investigate customer satisfaction. However, due to its general applicability, relatively simple handling and simplified interpretation of the data, the IPA proved to be a generally applicable instrument used in research and practice in various fields and disciplines (Kitcharoen, 2004; Abalo et al., 2007; Silva & Fernandes, 2010).

In this article, the dimensions "importance" and "performance" of the competence elements are examined. The positioning of the two dimensions is based on the respective arithmetic mean values in importance and performance. The quadrants are defined using the total arithmetic averages.

2.3 Results

2.3.1 Demographics

All students present took part in the two surveys which results in a data basis of n = 58 participants at the beginning of the course and a data basis of n = 59 participants at the end of the

course. In the first survey, 62% of the participants were female and 38% male. The average age was 21.03 years, and over 93% were in the second semester of a bachelor's programme. In the second survey, demographic values changed only marginally. 61% of the participating students were female, 39% male and the average age was 21.36 years. Almost 95% of the participants were in the second semester.

2.3.2 Results IPA

The results of the IPA concerning the three competence areas according to ICB 4 show at both survey times that due to the positioning in the first quadrant ("Concentrate Here") the participants assess the highest development potential in the competence area "Practice". The perceived level of performance is low, but the perceived relevance is above the overall mean and is therefore relatively high. Quadrant 2 ("Keep up the good work") contains the competence area "People which shows the highest perceived relevance and performance on average. According to the results of the IPA, the "Perspective" competence area is located in quadrant 3 ("Lower Priority"). Both in terms of perceived relevance and perceived level of performance, the "Perspective" area is below the total mean values. Figure 3 shows the results of the IPA survey at the beginning and end of the course.
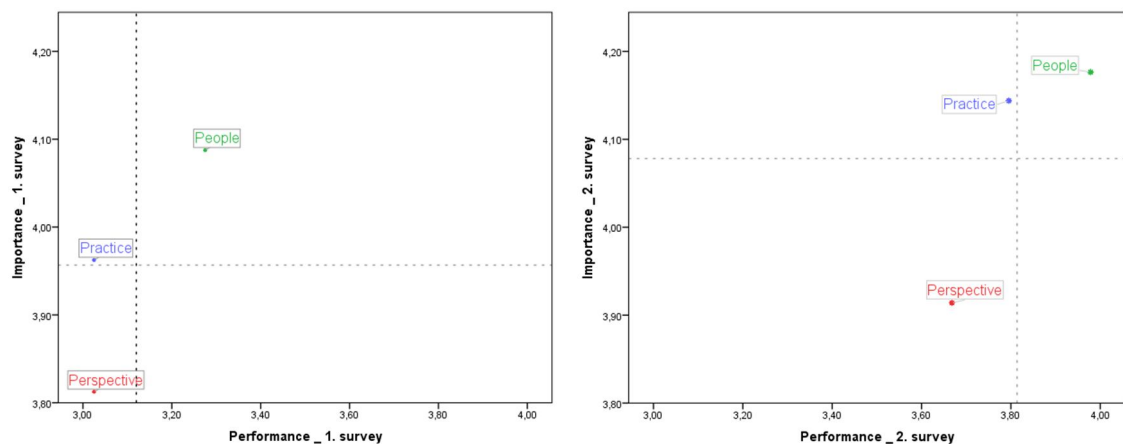

Fig. 3: IPA competence areas

The assignment of the competence areas to the respective quadrants remains the same in both surveys. However, the absolute positions change both with regard to the perceived relevance and concerning the perceived performance level. The perceived performance shows a relatively constant and positive development: all three competence areas are rated higher in the second survey. As in the first survey, the "People" area has the highest perceived level of performance, followed by the "Practice" and the "Perspective" areas. The perceived relevance also changes between surveys. The most substantial increase can be observed in the "Practice" area, the second largest in the "People" area. Far less is the area of competence "Perspective" increasing in this respect.

All competence areas develop concerning the dimensions of relevance and performance. Despite a proper development regarding the perceived level of performance, however, the aggregated context competence elements ("perspective") are still classified as relatively unimportant.

The IPA is carried out with the individual competence elements for an in-depth analysis of the areas of competence. Figure 5 illustrates the results of the first survey. The individual competence elements are grouped according to their affiliation with the competence areas and colourcoded.
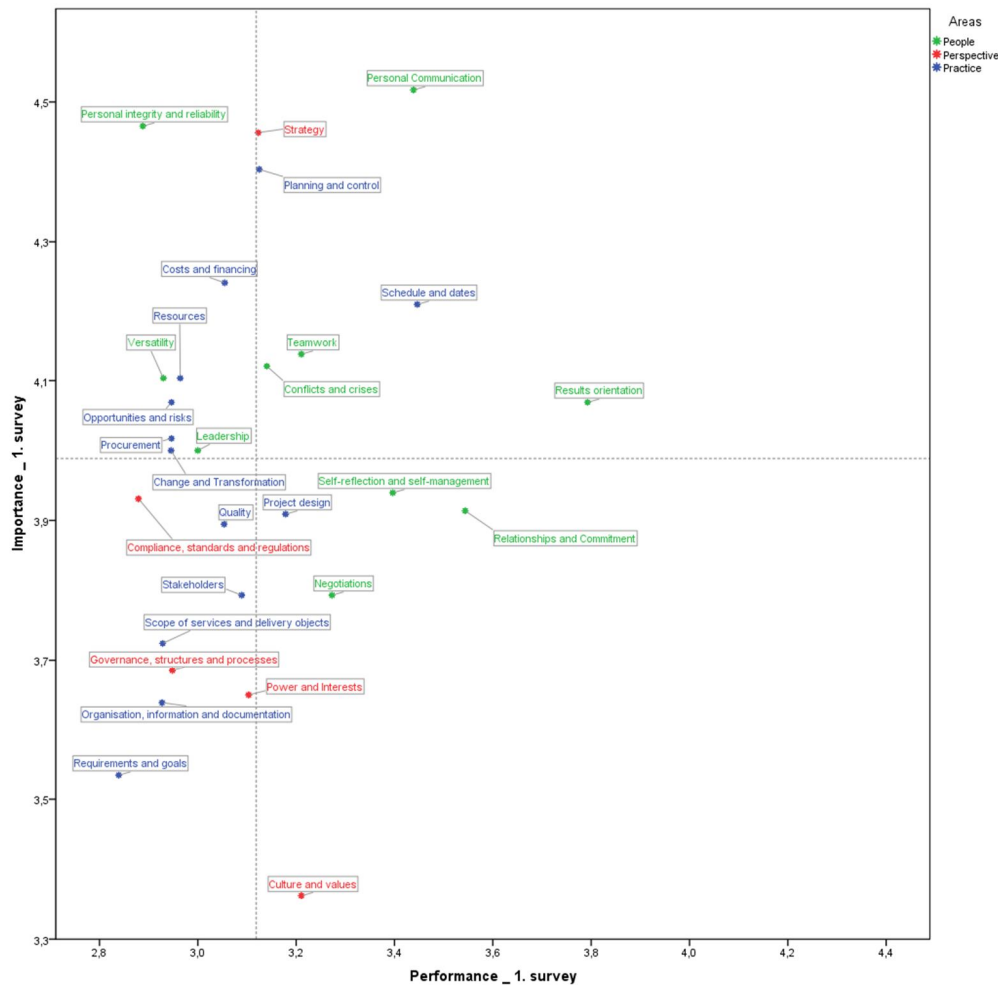
Fig. 4: IPA competence elements 1st survey

The results of the first surveys emphasize the particular importance and development potential of the elements Personal Integrity and Reliability as well as Versatility and Leadership in the area of "People". Quadrant 1 ("Concentrate Here") also contains resources, opportunities and risks, costs and financing as well as change and transformation from the "Practice" area. The highest importance is attached to the element personal communication positioned in Quadrant 2 ("Keep up the good work"). The elements strategy, as well as planning and control, are also classified as important with an above-average performance. The competence elements governance, structures and processes, power and interests as well as compliance, standards and regulations from the area of "Perspective" and, among other things, requirements and goals, organization, information and documentation as well as scope of services and delivery objects from the area of "Practice" are positioned least significantly in Quadrant 3 ("Lower Priority"). The least perceived relevance is shown by the element culture and values ("Perspective"), which is positioned in Quadrant 4 ("Possible Overkill") in addition to the elements relationships and commitment, self-reflection and negotiations assigned to the area "People" and the element project design assigned to the area "Practice". These elements can be classified as too good according to their relevance. The highest perceived level of performance can be seen in results orientation, followed by relationships and commitment.

Overall, there is initially a relatively low-performance assessment of all competence elements. Concerning relevance, it can be seen that in particular the social and personal competence elements ("people"), above all communication, personal integrity and reliability, are classified as particularly important. In terms of perceived performance, too, many elements from the "People" area are ahead.

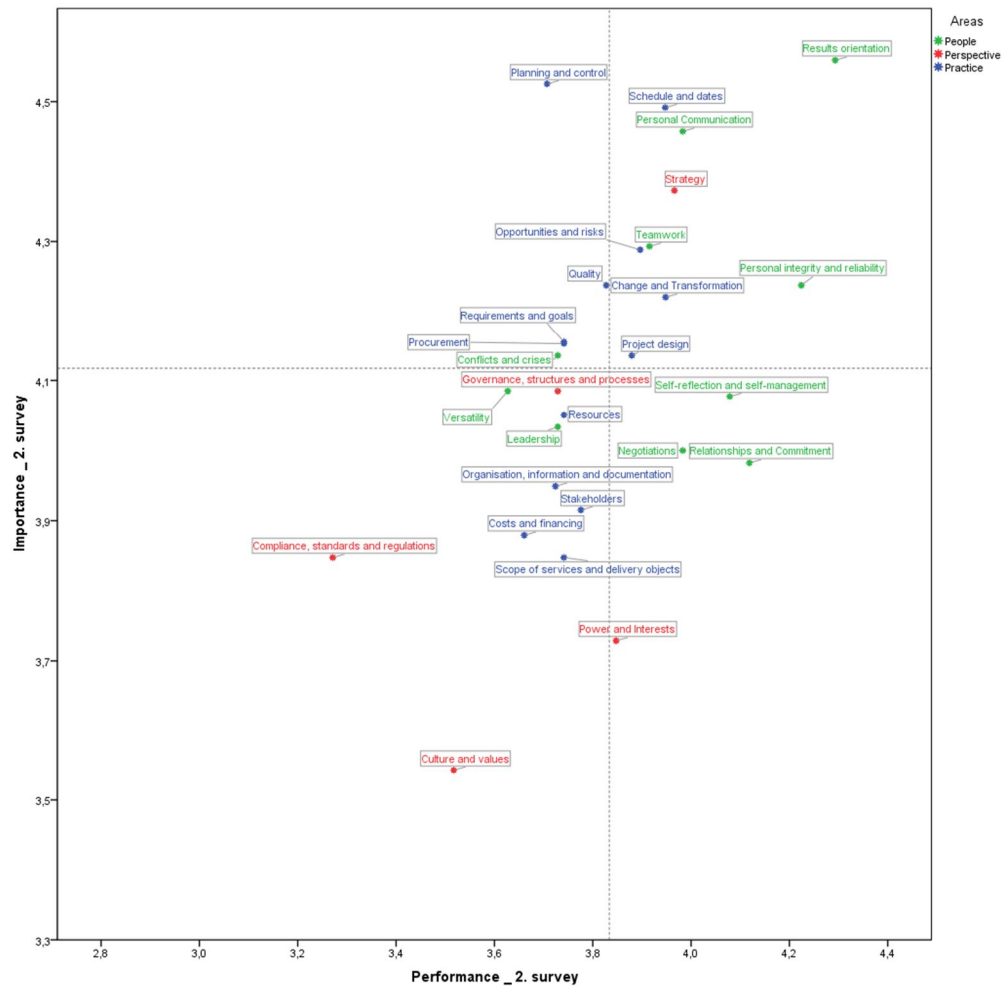Figure 6 shows the results of the IPA survey at the end of the course.

Fig. 5: IPA competence elements 2nd survey

The elements from the "People" competence area are still rated relatively high in terms of both relevance and performance. In the second survey, the most important average value was assigned to result orientation ("People"), followed by planning and control ("Practice"), procedures and deadlines ("Practice") and personal communication ("People"). Except planning and control, there is a perceived performance level above the mean value and thus a positioning in quadrant 2 ("Keep up the good work"). The highest development potential is seen predominantly in elements from the "Practice" area. In quadrant 1 ("Concentrate Here"), four elements are positioned: Planning and control, quality, requirements and goals. The competence area "Perspective" is perceived as less relevant in the second survey. Only the element strategy is above

the mean value. The remaining ones, such as culture and values, which is last in the first survey, as well as compliance, structures and regulations remain in quadrant 3 or 4.

Overall, it can be seen that the perceived level of performance has increased significantly on average. The perceived relevance has also increased for the majority of competence elements. To determine the largest changes in individual elements, the development path in the diagram is calculated from the difference between the perceived relevance and the perceived performance. The greatest development can be observed in the element Personal Integrity and Reliability from the "People" area, followed by the elements from the "Practice" requirements and goals, change and transformation as well as opportunities and risks. The fifth-largest change shows governance, structures and processes from the "Perspective" area. The social and personal ("People"), as well as the technical ("Practice") competence elements, are also ahead concerning the development between the surveys.

	Δ Importance	Δ Performance	Change in diagram
Personal Integrity and Reliability (People)	-0.23	1.34	1.36
Requirements and Goals (Practice)	0.62	0.90	1.09
Change and Transformation (Practice)	0.22	1.00	1.02
Opportunities and risks (Practice)	0.22	0.95	0.98
Governance, Structures and Processes (Perspective)	0.40	0.78	0.88

Tab. 2: Competence elements with the highest developments

There is a substantial increase in perceived performance of personal integrity and reliability (1.34). Besides, the importance of demand-oriented and goal-oriented work is made particularly clear (0.62).

3 Conclusion

The present contribution aims to investigate the development of the perceived relevance and performance of project-management-specific competences within the framework of project-oriented learning. Overall, the results obtained show:

- The majority of competence elements are subject to substantial development in the course of project-oriented teaching, both in terms of perceived relevance and perceived performance.
- Social and personal competence elements are regarded as particularly important and are developing strongly in terms of the level of performance.
- Technical competences show great leaps in development both in terms of relevance and in terms of the level of performance.
- Context competencies are perceived as less relevant. Both the development in terms of the level of performance and relevance are relatively small.
- Personal communication is consistently regarded as a particularly relevant competence.
- After the students' initial experiences in project work and project management, the most important competencies assessed are result orientation, workflow and deadlines as well as planning and control.

The results regarding the change in perceived relevance and perceived competence development between the surveys suggest that *project-oriented learning can make a significant contribution to the acquisition of the necessary project-management-specific qualifications.* Project-oriented learning has a particularly strong impact in terms of personal and social ("people") as well as

technical ("practice") competence elements. Relatively small influence of project-oriented learning can be observed in the context competence elements ("perspective"), especially concerning the perceived relevance. It seems challenging to convey the relevance of these competence elements, such as "culture and values" or "compliance, standards and regulations", insofar as they can hardly be integrated or made visible within the framework of the project-oriented form of teaching examined.
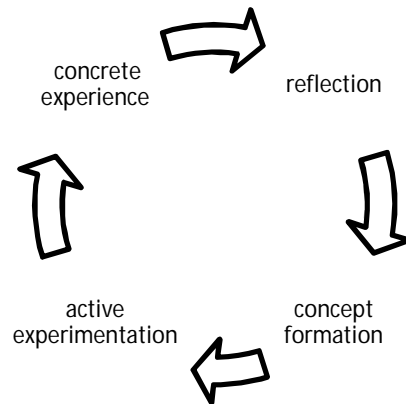

Fig. 5: The experiential learning circle after Kolb (1984)

In the context of the circle of experiential learning (Kolb, 1984) it can be stated that the project-oriented teaching method focuses on the two dimensions of learning stages "active experimentation" and "concrete experience". An extension of the field of action to the stage of "reflection" seems worth pursuing: Which learning success is perceived and based on what experiences did this success come about? From the authors' point of view, however, project-oriented learning cannot or only to a limited extent efficiently replace forms of teaching that impart knowledge.

The circle of experiential learning, according to Kolb (1984) can also be regarded as a frame of reference for curricular design: Competences arise in the interaction of cognition and action, of knowledge transfer and experience. Reflection and application in new situations act as links in the learning circle. The situation changes with the progress of the course: for example, a preparatory course and intensive support will be particularly relevant at the beginning of a course as well as for very complex topics. As the duration of studies progresses and the students gain experience, it can be assumed that the project work will be as independent as possible. For the teachers and supervisors, the challenge is to accompany the students based on their level of experience and to support them in an interdisciplinary and complex environment.

Project-oriented experience in the early stages of a study enables experience above all in the social area ("People"). It is shown that project-oriented learning has positive effects on competence development especially in this field ("People").

A limitation of this study lies in the observation of competence development, which was based on the subjective assessments of the participants and not on well-founded competence measurement methods. Although subjective self-assessment is used in some studies to measure competence, this approach is controversial and limited in terms of accuracy, resilience and significance (Klieme & Hartig, 2008). The results of the present study can, therefore, be used to observe and demonstrate development trends and effects of project-oriented learning, but it is not possible to examine whether the respective competences have actually been acquired or further developed due to a lack of competence measurement procedures. Therefore, further studies should use such measurements, such as probabilistic or item-response models (Klieme & Hartig,

2008). A further limitation exists concerning the participating persons, most of whom had little or no experience in project work or project management. The results could change as experience increases or varies.

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