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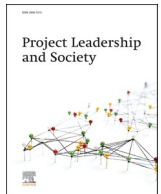
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Empirical Research Paper

Process competences to incorporate in higher education curricula

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ABSTRACT

This study reports on a survey on project managers' priorities. The survey used ISO 21500 as a scaffold to ask various respondents, like junior, experienced, and senior project managers, project sponsors, and students, to share their perceptions on the priorities for junior project managers. The respondent groups shared similar perceptions. Furthermore, project type and sector had little effect on junior project managers' priorities. Experienced and senior project managers shared their own priorities as well. The perceptions of priorities for junior, experienced, and senior project managers were mostly alike. However, experienced and senior project managers' priorities seemed slightly more affected by project type and sector. A session with experts in project management and teaching project management highlighted that the results for junior project managers could provide accents for introducing project management to students in higher education, provided the entire playing field of project management is also introduced.

1. Introduction

The teaching and training of project management (PM) in higher education is getting critique on multiple aspects. There is critique on what should be taught (Córdoba and Piki, 2012; Durrani and Baroudi, 2015) and how it should be taught (Berggren and Söderlund, 2008; Söderlund and Maylor, 2012). While graduates find it one of the most important skills in their curriculum, the teaching least meets their expectations (Kitchenham et al., 2005). In another study, only 39% expressed satisfaction with the PM theory in their software project management education, and even less satisfaction with practical PM skills like leadership and crisis management. An extensive study by Nijhuis (2017) on teaching practice showed even more grounds for critique with a lack of constructive alignment between aspired level and methods of teaching and assessment. Moreover, it showed a gap between incorporated subjects and the suggestions by practitioners on what should be incorporated.

This study aims to find the educational needs for teaching PM in higher education. The literature review will highlight several publications on this subject.

The teaching and training of PM aim to improve learner competences. Several studies have tried to define the competences needed for

successful PM. Nijhuis et al. (2018) published an overview of 30 previous competence studies, concluding that they did not provide a basis for educational needs. Moreover, this review showed that the competences used in previous studies were *attribute-based*, "the processes brought to the job" (Crawford, 2005, p. 9). Therefore, this research focuses on the "demonstrated performance" or the "ability to perform the activities within an occupational area" (Crawford, 2005, p. 9).

In PM, the activities are strongly linked with the processes described in ISO 21500 for PM (International Organisation for Standardization, 2012), such as managing risks or integrating the project initiating phase. This ISO standard presents processes in a matrix across five stages and 10 subjects.

The ISO matrix provides a complete overview of PM processes. Moreover, it resembles the matrix of processes in the PM Body of Knowledge (PMBOK, Project Management Institute, 2021). One can claim that a project manager needs to master all processes in the ISO matrix since they "are important and have impact on project performance" (Tavan and Hosseini, 2016, p. 29). However, the limited space dedicated to project management in the curriculum necessitates focus. Therefore, this research aims to identify the processes that have priority in the daily job of the project manager to build a research-informed basis for training project managers.

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Research on priorities for PM processes is scarce. For instance, there has been no exploration of whether all processes have equal priority in practice. A higher priority could indicate a focus for the teaching of PM. Several studies have pointed to context-dependence of project manager competences, such as the leadership styles needed to achieve success (Turner and Müller, 2006). Contextual factors generally considered are project type, geographic region, and sector (Nijhuis et al., 2018). Project type, such as construction, engineering, or information and communication technology (ICT), is an interesting factor for higher education, with specific curricula in, for instance, Built Environment, Engineering, and ICT. Whether project type affects the priority of processes in PM has not yet been established.

Another interesting factor for higher education is the influence of PM experience on needed competences. The bulk of higher education for PM is aimed at students with no prior PM experience. Preliminary research indicated a possible effect of PM experience on prioritized processes (Nijhuis et al., 2018). Therefore, this research aims to explore that effect.

The final aim of this research is to explore the effect of the respondents' viewpoint. The perception of what is necessary for PM depends on the respondent's viewpoint (Gadeken, 2000). PM education includes several stakeholders (Wearne, 2008), such as students, practitioners, and their managers. Therefore, this research explores and compares these stakeholders' perceptions of what processes junior project managers need to give priority to.

This study reports findings from a survey conducted with 299 respondents on process priorities for project managers, exploring the influence of project type, PM experience, and viewpoint on what processes are prioritized. After the literature review and an overview of the methodology, the overall results are discussed. Next, specific analyses of results regarding junior, experienced and senior project managers are presented. An expert panel of PM and PM teaching experts discussed the results and their implications for higher education. A summary of their meeting precedes the discussion of the results, followed by conclusions and suggestions for further research.

2. Literature review

A considerable body of scholarly papers on teaching PM in higher education exists, Nijhuis (2017) identified 26 of them. Publications on PM competences are readily available, with 30 incorporated in a review in 2018 (Nijhuis et al., 2018). However, early career PM is seldom the focus of research. Searching for junior/beginning/starting project manager on WorldCat revealed no useful research paper (details in Appendix E). Havermans et al. found that project managers mostly “roll into the profession” (2019, p. 346) without explicating the competences needed or classifying proficiency levels like junior or senior. Akkermans et al. (2020) recently pleaded for more research in project management careers without explicating research on teaching needs.

Five of the 30 incorporated studies in an earlier review (Nijhuis et al., 2018) could be considered aimed at competences needed to teach, with varying research questions and results. Brill et al. (2006) found 60 important¹ competences for an effective project manager. Stevenson and Starkweather (2010) delivered six PM competences most valued among IT executives. Focusing on engineering, Ortiz-Marcos et al. (2013) produced six competences most relevant.² A fourth study produced 13 key competences (Dias et al., 2014). Finally, based on the industry's needs, Durrani and Baroudi produced 12 required knowledge and skills competences (2015). All studies favour generally important competences, usually already incorporated in higher education curricula, like various forms of communication, analytical thinking, computer skills, and problem-solving (Nijhuis et al., 2018).

A more recent study, aimed at early career project managers,

examined their work readiness (Borg et al., 2023). This study identified seven essential early career PM skills: stakeholder communication, leading meetings, professional software competency, construction technical knowledge, earning respect, handling bad behaviour, and understanding career progression. Although an elaborate research, these results do not differ from earlier PM competence research, favouring general important competences.

It should be noted that publications on PM pertaining to “what it takes to do the job” use various terms like skills, qualifications, knowledge, ability, competence, competency, and more. On closer examination, these all fall into the encompassing definition of competence by Crawford (2005), splitting competence into attribute – knowledge, skills, and attitude – and demonstrated performance – the results achieved. Since previous studies, focused on attribute competences, did not produce a basis for the educational needs in PM (Nijhuis et al., 2018), this study focuses on demonstrated performance in the form of high-priority PM processes.

A search for literature on PM process priorities resulted in very little useable information. Searching for articles with the terms “project”, “management”, “process”, and “priority” in the abstract using Worldcat worldwide returned 813 results – mostly related to specific projects in various areas and not to PM research. In cases where PM was mentioned, the articles were mostly related to portfolio management (selecting the best projects) or risk management (selecting suitable risks or measures). The remaining four articles revealed nothing about priority in PM processes.

Searching for literature with “PM” in the title and “(ISO) 21500” in the abstract on WorldCat returned seven articles. However, only one hinted at exploring essential processes by making an inventory of often-used processes in information systems PM, using both PMBOK and ISO 21500 (Varajão et al., 2017). Their results are analyzed in the discussion session. A search for articles containing “PMBOK” in the abstract and “Project Management” in the title returned 51 articles on WorldCat, including the aforementioned Varajão et al. (2017) and one researching the success factors connected with PMBOKs' knowledge areas (Niazi et al., 2016). However, the success factors mentioned in the article were not processes, the topic of this study. A search on “priority” and “process” in the abstract and “PM” in the title found no additional articles to consider. The discussion session will reflect on this gap found in the literature.

Although the literature on priority within management tasks is also scarce, it did supply some interesting insights for this study. For instance, Dixon (2003) underlined a focus on performance, stating that a manager's effectiveness should be judged by what is achieved (p. 271). His book provided an overview of management tasks but did not supply priorities. However, a task focus is in line with performing processes studied here.

Time pressure necessitates priorities, and training can play a positive role. Gutzwiller and Sitzman (2017) showed that training could improve prioritization in an overload situation in a laboratory experiment. Likewise, research in the aviation sector showed that trained pilots favour high-priority tasks over low-priority tasks when the workload increases (Raby and Wickens, 1994). Both studies used a simulation to assess the effects and knowledge of what tasks should have high and low priorities. Similarly, Xu et al. (2016) proposed a scheduling principle to assign priorities among active management tasks based on the due date and non-completion penalty costs. However, to the best of the researcher's knowledge, high and low priorities or penalty costs in PM have not been researched.

The literature showed that setting priorities is important and can be influenced by training. However, the research was performed in a laboratory or simulation, restricting the number of participants and tasks to study. Moreover, a simulation presents a controlled version of the work situation, with parameters selected by the simulation designer. Therefore, it is only an estimation of what the actual workflow would be like, and it requires a considerable time investment by the participant. This

¹ Scoring a mean of 4.0 or higher on a 5-point Likert scale.

² Scoring a mean of 4.0 or higher on a 5-point Likert scale.

research aims to acquire a broad overview of priorities in PM by asking different respondent groups with experience in various project types about their perceptions of priority processes for PM. More specifically, it aims to explore the PM priorities when doing the job of a junior project manager. This information will result in actionable knowledge for teaching PM in higher education.

3. Method

A survey was conducted to gather data on project managers' priorities. The survey was built on earlier research on attribute competences and process priorities (Nijhuis et al., 2018; Nijhuis et al., 2018). The survey's main question was to mark the priorities using an adapted blank ISO 21500 matrix.

The original ISO matrix comprises five stages and 10 subjects. It arranges 39 processes in 26 cells; 24 cells are without processes. Previous research suggested the addition of an 11th subject, added value management (Nijhuis et al., 2018). For an illustration of the resulting matrix, see Table 5.

Moreover, participants in prior studies found some of the processes intertwined and some of the boundaries theoretical. Therefore, a blank matrix was tested and proven useful (Nijhuis et al., 2018). This study called the combination of a subject (e.g., time management) and a stage (e.g., planning) a PM process (time management during the planning stage, or plan time management).

3.1. Participants

The study included 299 respondents: 21 self-proclaimed junior project managers, 48 experienced project managers, 78 senior project managers, and 46 students in higher education expecting to become project managers. Other groups included project team members, consultants to projects, managers of project managers, educators/trainers, portfolio or program managers, project managers with an unspecified level of experience, sponsors, and "other".

Over half of the responses originated from distribution at meetings, and a little under 15% from completely open distribution (LinkedIn). The remainder originated from companies and special interest groups that spread the survey through their channels. Results were mainly from Europe, with 92% of the respondents; within Europe, the majority (98%) were from the Netherlands. Therefore, the Netherlands is overly represented. The implications of this over-representation are described in the discussion section.

The self-defined experience level was mostly based on PM experience, which varied upon seniority (junior project managers: $M = 1.5$, $SD = 0.8$; experienced project managers: $M = 6.2$, $SD = 3.4$; senior project managers: $M = 16.8$, $SD = 7.0$). Respondents had an average project experience of 13.0 years ($SD = 10.9$), which also varied upon seniority (students: $M = 2.0$, $SD = 1.9$; junior project managers: $M = 3.8$, $SD = 2.8$; experienced project managers: $M = 10.3$, $SD = 5.2$; senior project managers: $M = 22.0$, $SD = 5.2$). The experience in projects before starting as a project manager varied with seniority as well (junior project managers: $M = 2.6$ years, $SD = 2.4$; experienced project managers: $M = 4.4$, $SD = 3.8$; senior project managers: $M = 5.0$, $SD = 3.8$) as did the age of becoming a project manager (junior project managers: $M = 28.7$ years, $SD = 5.3$; experienced project managers: $M = 33.8$, $SD = 7.9$; senior project managers: $M = 34.1$, $SD = 6.0$).

3.2. Survey

LimeSurvey Version 3.15.6 served as the basis for the survey. Respondents were first asked several questions about their characteristics, such as current involvement with PM, years of project experience, and formal and specific education (see Appendix A for the complete survey). Then, the matrix was presented, with the instruction to mark a maximum of 10 processes (combinations of stage and subject) that they

perceived as priority PM processes for junior project managers. However, if the respondent indicated to be a project manager, the presented question was to mark their own priorities.

After this matrix, the survey collected opinions of respondents on the preparation junior project managers should have. Concluding questions included several more respondents' characteristics such as gender, age, experience with project types and project phases, and area of work. Project managers were asked specific questions such as their projects' budget and time span.

As the last question, experienced and senior project managers were presented the blank matrix a second time with the request to select the 10 PM processes that should have priority for a junior project manager. A total of 38 experienced project managers and 64 senior project managers completed the matrix twice (81%). Their own priorities based on project type and sector are reported in Appendix C.

The setup was tested by several project managers and Surveybusters from the Dutch chapter of PMI to ensure that the questions were appealing and understandable for the target groups. A paper version was available when needed.

3.3. Analysis

Paper surveys were processed through the data entry module of LimeSurvey. Different respondent groups were digitally labeled, including participants in conference X, project managers in the health sector, students of curriculum Y, respondents from commercial firm Z, and open distribution. This information could be used for further analysis.

The digital version enforced a maximum of 10 processes. Paper responses in which more than 10 processes were marked were given some leniency regarding cut-off; responses were only discarded if 12 or more were marked. Only completed surveys were analyzed. This research is interested in the perception of prioritized processes for project managers and the differences in those perceptions for various respondent groups. The analysis combined findings from consultants, portfolio or program managers, sponsors, and project team members as *project-experienced*.

SPSS version 25 was used for statistical tests on those differences. Chi-square analysis, McNemar's test, and the Wilcoxon signed-rank test were used to test for differences in priorities between respondent groups and for differences between perceptions for their own work as a project manager versus their perceptions for junior project managers' work. When multiple series of tests were conducted, the Bonferroni correction was used to adjust the significance level (Field, 2018).

Next, priority profiles were compiled per respondent group. To identify priorities, a crude Chi-Square is used. Cells with a relative marking of 1.5 times the average marking of that respondent group were called a priority. All respondents marked on average 9.3 cells ($SD = 2.3$). The average frequency for each cell was $9.3/55 = 16.9\%$. Therefore, it was a priority when it was ticked by more than $1.5 \times 16.9\% = 25.4\%$ of all respondents (see Table 5 for the priorities according to all respondents, see appendix D for an in-depth discussion of the crude Chi-Square). Note that the percentages were related to the actual frequency of marking by the specific respondent group, which in practice hardly differed (see Appendix B for some examples).

The priority cells of a specific respondent group together are called a *profile*.

4. Results

Most project managers had experience with several project types, between 1.6 and 2.4 project types on average, as shown in Table 1. The best-represented project type was ICT projects, followed by organizational projects.

The project managers reported involvement with an average of 3.4 stages for junior ($SD = 1.7$) and experienced project managers ($SD = 1.8$) and 3.9 for senior project managers ($SD = 1.6$). A large majority of project

Table 1
Reported experience with project types.

	ICT	BE	CI	Eng	Org	Edu	Events	M	SD
Junior PM (21)	50%	46%	10%	62%	54%	27%	0%	2.0	1.3
Experienced PM (48)	49%	20%	7%	41%	28%	17%	7%	1.6	0.8
Senior PM (78)	87%	12%	10%	23%	71%	30%	14%	2.4	1.1
All respondents (299)	69%	21%	12%	37%	62%	39%	18%	2.1	1.2

Note. Project types: *ICT* = Information and Communication Technology, *BE* = Built Environment, *CI* = Creative Industries, *Eng* = Engineering, *Org* = Organizational, *Edu* = Project in education (not project-based learning). *M* is the mean number of project types marked by the respondent group, and *SD* is the standard deviation.

managers had a degree from higher education. Juniors less often had no degree and more often had obtained a master's degree (see Table 2).

Respondents ticked whether their formal education paid attention to PM, with options as illustrated in Table 3. Acting project managers ticked the options less often than students. Several project managers mentioned – under the option 'other' – that their studies did not pay any attention to PM. In contrast, the student participants in this research were enrolled in a program of study that included PM education. Just over half of these students reported that attention was paid to practical PM skills (undefined). Across groups, most attention was paid to working in projects and PM theory. Overall, senior project managers reported the least attention in their formal education, with all items scored lowest by this group.

The respondents were asked whether project managers should have experience with PM methods and whether they should have a certificate in PM. Overall, the respondents thought junior project managers should have experience with PM methods, preferably before they start working as a project manager. This percentage was highest among the managers and the students (see Table 4). A considerable portion, 22% of all respondents, did not think experience with PM methods to be necessary. The majority of respondents saw certification as unnecessary, particularly certification before starting.

4.1. Differences between perceptions of their own and junior project managers' priorities

The 81 respondents who supplied both their own priorities and the priorities for junior project managers had an average difference of 5.3 priorities ($SD = 2.2$), or roughly half of the priorities marked. However, how often each cell was chosen showed no significant differences between their own and junior project managers' priorities, using McNemar's test (adjusted p-level: $p = 0.001$).

At a cumulative level, the Wilcoxon signed-rank test on subjects and stages showed one significant difference between their own and junior priorities (adjusted p-level: $p = 0.005$). The subject stakeholder management was selected significantly more often as a priority for project managers themselves than they selected it for junior project managers ($z = -3.838$, $p = 0.000$). Other subjects and stages displayed differences as well, but never that strong. Time management showed a relative higher priority for juniors. According to experienced and senior project managers, juniors need to give more priority to planning and implementing, and less priority to initiating and controlling than they do themselves. However, these differences were not significant in this study.

The perceptions of experienced and senior project managers of their own priorities are included in Appendix C. The discussion section will provide a short recap of their results. The remainder of this study focuses on the perceptions of junior project managers' priorities.

Table 2
Reported educational level for project managers.

Group	No degree	Bachelor's	Master's	PhD
Junior PM (21)	4%	33%	58%	4%
Experienced PM (48)	6%	50%	40%	4%
Senior PM (78)	12%	37%	36%	5%

Table 3
Attention paid to PM in their most recent formal education.

Group	Working in projects	Leading groups	PM Theory	Practical PM skills	PM Methods
Students (46)	76%	35%	63%	54%	35%
Junior (21)	63%	33%	58%	21%	17%
Experienced (48)	67%	35%	46%	35%	21%
Senior (78)	40%	26%	26%	27%	28%

4.2. Prioritized processes for junior project managers

The first analysis focused on the prioritized processes for junior project managers according to various respondent groups related to project (management) experience, project type, and labeled sectors. Junior project managers themselves were a small respondent group, with only 20 respondents supplying their priorities, compared with 221 others who supplied priorities for junior project managers.

Almost all cells were marked by at least one respondent. The most often chosen priority process was initiating stakeholder management, which was marked as a priority by 48% of the respondents. The selection frequency for all cells chosen as junior project manager priorities by all respondents is shown in Table 5. Respondents marked on average 9.3 cells ($SD 2.3$).

4.3. Junior project manager prioritized processes per project experience

This section focuses on the project management priorities for junior project managers according to respondent groups based on project experience (see Table 6 for an overview of the groups). Their profiles exhibited commonalities. Planning was the stage with the most priority processes. In contrast, closing was almost wholly ignored. Table 6 presents the profiles for the different respondent categories; Appendix B lists all results for this overview matrix. There are no significant differences between the respondent groups (adjusted p-level: $p = 0.01$, $\chi^2(5) = 3.907$, $p = 0.563$).

As illustrated in Table 6, differences between junior project managers' profiles were mainly in the implementing stage. This stage had six cells selected by one or two respondent groups as a priority that fell outside the overall profile. The different respondent groups selected almost the same number of priorities in the implementation stage (16) and the controlling stage (18). However, the controlling stage showed greater focus on the subjects that were included. Planning had the most priorities, roughly equal to implementing and controlling combined. Initiating trailed a little behind implementing and controlling.

The difference between the profiles of the groups was limited, and there was no respondent group revealing a very different profile. The junior project manager respondents were the least conformist group, with five priorities outside the overall profile. Only a few subjects had a considerably low number of priorities included: procurement and added value (both 1), integration (3), and quality management (5). All other subjects had eight or more priorities selected.

Table 4
Should Junior Project Managers Have Experience with PM methods?

Group	Experience in PM methods				Certificate in PM			
	n	Before	After	No	n	Before	After	No
All respondents	267	55%	23%	22%	262	18%	31%	51%
Junior PM	21	48%	29%	24%	20	30%	30%	40%
Experienced PM	45	47%	22%	31%	43	26%	21%	53%
Senior	73	48%	32%	21%	73	10%	33%	58%
Managers	13	77%	15%	8%	13	15%	62%	23%
Educators	13	38%	38%	23%	13	0%	23%	77%
Project-experienced	49	53%	24%	22%	50	14%	40%	46%
Students	44	77%	7%	16%	41	34%	20%	46%

Note. Both questions had three answer options: 'Yes, before they start as project managers' (*Before*), 'Yes, after they started as project managers' (*After*), and 'No, that is not necessary' (*No*). Project-experienced is the combination of consultants, portfolio managers, program managers, sponsors, and project team members.

Table 5
All Respondents (241) on Junior Project Managers' Priorities.

Subject \ Stage	Initiating	Planning	Implementing	Controlling	Closing
Integration	15%	13%	22%	8%	3%
Stakeholder Management	48%	19%	18%	12%	4%
Scope Management	36%	41%	16%	15%	1%
Resource Management	13%	40%	22%	8%	0%
Time Management	9%	44%	24%	35%	3%
Cost Management	13%	29%	14%	29%	2%
Risk Management	19%	38%	23%	20%	2%
Quality Management	5%	17%	19%	30%	3%
Procurement	2%	20%	7%	10%	0%
Communication Management	9%	27%	41%	17%	5%
Added Value Management	14%	13%	12%	19%	8%

Note. Adapted ISO 21500 matrix showing subjects in rows and stages in columns. Processes are at the intersections of subjects and stages, for instance, implementing integration. Added value management was included as a subject based on reactions from the focus groups in an earlier study (Nijhuis, 2021). Cells show the percentage of respondents marking that cell as a priority. Highlighted in yellow are the priority cells, cells with values more than 1.5 times the average value of 16.9% = 25.4%.

4.4. Junior project manager prioritized processes per project type

The second analysis for junior project managers' priorities focused on perceptions of respondent groups based on the types of projects they had experience with.³ As with the previous analysis, the results showed both differences and commonalities. Again, there are no significant differences between the respondent groups (adjusted p-level: $p = 0.007$, $X^2(6) = 1.153$, $p = 0.979$).

Table 7 presents the profiles for the project types included in the survey. Both the implementing and the controlling stage included several cells chosen by a minority of respondent groups. Although showing slightly different totals over stages, the results were the same as the previous comparison, with controlling outnumbering implementing. The planning stage again had more included priorities than implementing and controlling combined. The initiating stage included almost as many identified priority processes as implementing.

As illustrated in Table 7, one project type stood out from the rest: V = Events. Respondents with experience with this project type chose eight priorities outside of the overall profile. Moreover, in five of those

cells, the respondents having experience with event-related projects were the only group marking it as a priority. The other project type-related respondent groups had three or fewer priorities in cells outside the overall profile. However, the markings of the respondents with events-related PM experience were not significantly different from any other respondent group.⁴ Moreover, the priorities chosen by the respondents with events-related PM experience include almost all of the priorities in the overall profile. A different result worth noting is the comparative results of respondents with ICT experience and respondents with Engineering experience. These are significantly positively correlated ($p = 0.01$), while the respondents reporting experience in these types are negatively correlated ($p = 0.01$).

Three subjects had only one priority identified: added value, procurement, and integration. The rest of the subjects each had seven or more (see Table 7).

4.5. Profiles for junior project manager prioritized processes per sector

Four sectoral groups were represented in the sample: project

³ Note that participants had the option of selecting more than one type of project – see Table 1.

⁴ Not even when comparing them one-on-one and not applying the Bonferroni correction.

Table 6
Profiles for Junior Project Managers per Project Experience.

Subject \ Stage	Initiating	Planning	Implementing	Controlling	Closing	Total
Integration	Jr		E S			3
Stakeholder Management	Jr E Sr S P M	Jr M	Sr			9
Scope Management	Jr E Sr S P	Jr E Sr S P M	Sr			12
Resource Management		Jr E Sr S P M	E P			8
Time Management		Jr E Sr S P M	Sr M	Jr E Sr S P M		14
Cost Management		Jr E Sr S		Jr Sr S P M		9
Risk Management		Jr Sr S M	E P	Jr S		8
Quality Management		S		Jr E S P		5
Procurement		Jr				1
Communication Management		Jr E Sr	Jr E Sr S P M			9
Added Value Management				M		1
Total	12	33	16	18	-	

Note. Adapted ISO 21500 matrix showing subjects in rows and stages in columns. Processes are at the intersections of subjects and stages, for instance, implementing integration. Added value management was included as a subject based on reactions from the focus groups in an earlier study (Nijhuis, 2021). Cells with a relative marking of 1.5 times the average marking of their subgroup are called a priority. The set of priority cells for a respondent group is called a profile. The highlighted cells indicate the priorities for juniors by all respondents (241 respondents; see Table 5) and indicate the overall profile for juniors. The letters denote the profiles for junior project managers per subset of respondents, based on project experience: *Jr* = Junior Project Manager (20 respondents), *E* = Experienced PM (38), *Sr* = Senior PM (64), *S* = Student (36), *P* = Project-experienced (48), and *M* = Manager of PMs (13). Totals are listed for the number of priorities per subject and stage.

Table 7
Profiles for Junior Project Managers per Project Type.

Subject \ Stage	Initiating	Planning	Implementing	Controlling	Closing	Total
Integration			V			1
Stakeholder Management	I B E O Ed V	C		C V		9
Scope Management	I B O Ed V	I B C E O Ed V		V		13
Resource Management		I B E O Ed V	V			7
Time Management		I B C E O Ed V	I O V	I B C E O Ed V		17
Cost Management		I B E O Ed	B	I B C E O Ed V		13
Risk Management	B	I B C E O Ed V	I	V		10
Quality Management		B Ed	Ed	I O Ed V		7
Procurement		E				1
Communication Management		I B C Ed V	I B C E O Ed V	V		13
Added Value Management				V		1
Total	12	41	15	24	-	

Note. The highlighted cells indicate the processes included in the overall profile for junior priorities from all respondents (241 respondents; see Table 5). Cells that received a relative marking of 1.5 times the average marking of their subgroup are called a priority. The set of priority cells for a respondent group is called a profile. The letters denote the subset of respondents based on experience with project types: *I* = experience in ICT projects (116 respondents), *B* = built environment projects (27), *C* = creative industries (53), *E* = engineering (53), *O* = organizational (90), *Ed* = projects in education (49), and *V* = events (22). Respondents marked, on average, more than one project type in which they had experience, see Table 1 Totals are listed for the number of priorities per subject and stage.

managers working in the health sector, in the government, for internationally oriented companies, and in a firm offering commercial PM services. This section analyses the priority processes for junior project managers according to sectoral groups. Several commonalities emerged even when restricting the analysis to half of the respondents, as

illustrated in Table 8. Again, the respondent groups showed no statistically significant differences (adjusted p-level: $p = 0.0125$, $X^2(3) = 2.851$, $p = 0.415$).

The implementing and controlling stages showed the most differences in profiles. Implementing had more identified priorities than

Table 8
Profiles for Junior Project Managers per Sector.

Subject \ Stage	Initiating	Planning	Implementing	Controlling	Closing	Total
Integration						0
Stakeholder Management	I H G C		H G			6
Scope Management	H G C	I H G C	C			8
Resource Management		I H G C	I			5
Time Management		I H G C	I H C	I G C		10
Cost Management		I C		I C		4
Risk Management	G	I G C	I H C	G C		9
Quality Management			H C	H G		4
Procurement						0
Communication Management		I H G	I H C			6
Added Value Management				G		1
Total	8	20	14	10	-	

Note. The cells highlighted in yellow indicate the overall profile for junior priorities from all respondents (241 respondents; see Table 5). Cells that received a relative marking of 1.5 times the average marking of their subgroup are called a priority. The set of priority cells for a respondent group are called a profile. The letters denote the subset of respondents based on the sector respondents work in: I = international business (40 respondents), H = health (22), G = government (27), and C = commercial firm supplying PM services (22). Totals are listed for the number of priorities per subject and stage.

controlling, and together they outnumbered planning. The initiating stage had slightly fewer priority processes than controlling.

There were no outlier groups; each sector profile had three or four cells for junior project managers' priorities outside the overall profile. Three subjects had few or no identified priority processes: procurement and integration had none; added value had only one, identified by respondents from the government sector. The subjects with four identified priority processes were notable. Quality management had three groups selecting it as a priority, and cost management had only two. All four

sectors supported the other subjects as having priority, each with at least five selected processes.

4.6. Prioritized processes per project management experience

Experienced and senior project managers were asked to mark their personal priorities on the blank adapted ISO Matrix. Table 9 shows four profiles: the overall opinion on priorities for junior project managers from all respondents (see Table 5), junior project managers' opinion of

Table 9
Profiles per Project Management Experience.

Subject \ Stage	Initiating	Planning	Implementing	Controlling	Closing	Total
Integration	J					1
Stakeholder Management	J E S	J E S	S			7
Scope Management	J E S	J E S				6
Resource Management		J E S				3
Time Management		J E S		J E S		6
Cost Management		J S		J E S		5
Risk Management	S	J		J S		4
Quality Management				J		1
Procurement		J				1
Communication Management		J E	J E S	E		6
Added Value Management						-
Total	8	18	4	10	-	

Note. The highlighted cells indicate the overall profile for junior priorities from all respondents (241 respondents; see Table 5). Cells that received a relative marking of 1.5 times the average marking of their subgroup are called a priority. The set of priority cells for a respondent group is called a profile. The letters denote the level of experience of project managers who were identifying their own priority processes: J = Juniors on their own priorities (20), E = Experienced on their own priorities (48), and S = Seniors on their own priorities (78). Totals are listed for the number of priorities per subject and stage.

their own priorities, and the experienced and senior project managers' own priorities. As before, the respondent groups showed no statistically significant differences (adjusted p-level $p = 0.0125$, $X^2(3) = 3.199$, $p = 0.362$).

The overview shows commonalities and differences in the identified profiles. The absence of risk management, integration and quality as a priority in the profile of experienced project managers is notable. Appendix C provides more details on the profiles for prioritized processes for experienced and senior project managers and reveals that these subjects had priority for the experienced project manager, but in different stages depending on the context.

5. Review session on junior priorities⁵

A panel with five experts in teaching PM discussed the survey results. They all had 10 or more years of experience teaching/training PM (13 years on average), and all had even more experience in PM (23 years on average).

The priority maps, as shown in Tables 6–8, led to a discussion in the group. Although there was a consistent image for juniors, was it desirable? The group questioned the absence of priority processes in the closing stage, which could cause system faults to remain. A focus on controlling could make closing easier, but that focus was missing in the identified priorities. They noted another concern; stakeholder management for juniors seemed to be a textbook approach: only identifying stakeholders (initiating stakeholder management), but stakeholder management lacked a priority in the implementing or controlling stages. The priority maps might be a good representation of the current state. However, the reviewers questioned if that state was a desirable one.

The panel was asked to pick a single respondent group to be trusted most in selecting the priority processes for junior project managers. Two favored students, and another two favored experienced project managers. Teachers and books could direct the students, but they lack work experience. Moreover, students receive more input than just from textbooks; they have access to publications on best practices and success/fail factors, which might create a broader vision of what is essential than people "in the profession" might have. The argument for choosing experienced project managers was the opportunity to reflect on past experiences to decide what should have been given priority in hindsight. The profiles of students, junior project managers, and experienced project managers were comparable, showing only minor differences.

The group felt that focusing on priorities was not a good line of thought for PM courses, as the priorities do not provide a complete picture of the playing field. If restricted to a short course (less than 140 student study hours), the priority map could provide accents and may be a good start for course design. Still, the breadth of the profession should be made clear. If there is more space – for example, in a minor – there should be more focus on the missing parts, such as controlling, and especially on closing. The experts recommended including experience with various methodologies such as value-based PM and Agile and showing students that there is more involved than the current priorities. For instance, student projects should start with lessons learned from the previous project. This would help deliver a generation that looks beyond current practice, and in that way, higher education would add value to the profession of PM.

It was noted that only limited competences can be achieved within the confinements of a short course. A short PM course should have the aim to prepare students to start as project manager by nurturing their ability to learn it in practice. Students should become familiar with the terminology and understand consistency: for instance, addressing an essential stakeholder in the communication plan and the risk

assessment.

If higher education has the goal of preparing students for PM work, then attention to PM should not be limited to a short PM course. PM should be intertwined with several other parts of the curriculum, including methodologies in project-based learning and (project) leadership in management courses. This approach would lead to a PM capstone course with deep learning opportunities, which would increase students' interest. Even with this structure, it would be too ambitious to have every student experience PM in the project manager role. All students should experience working on projects, for example, in project-based learning. Introducing cost as a fundamental factor – especially in balancing it with scope, quality, and time – may be too ambitious, given the limitations of higher education. Service-learning projects (Brown, 2000; G. Dixon, 2003; Munger and Gutowski, 2008)⁶ are not a viable alternative, as those projects are usually not realistic but are just small events. Incorporating attention to the stages of implementing and controlling in a short PM course would require simulations, if permitted by space and budget.

6. Discussion

The differences in geographic representation and methodological considerations are reviewed before discussing the results.

6.1. Global representation & methodology considerations

Analysis of global research on PM competences has shown that the same competences are mentioned (Nijhuis et al., 2018), supporting the comparison of non-Dutch-based with Dutch-based research. Earlier research on descriptions of the teaching of PM in higher education found no substantial differences between leading global institutions and Dutch institutions (E. Nijhuis, 2017). Although the current study was mainly based on Dutch respondents, it enables a comparison between European and non-European practices.

Twenty respondents from outside Europe gave an opinion on the priority processes for junior project managers. Compared to European-based respondents, they differed only slightly in their perception of junior project managers' priorities. Procurement was included more frequently and scope management less frequently outside of Europe. A large proportion of the non-European participants came from one engineering company in Mexico, where procurement is a priority. Their influence on the overall junior priority profile was visible in the inclusion of planning procurement as a priority process (J in Table 9 and Jr in Table 6).

The European-based respondents did not share this priority. It is speculative that a broader distribution in Mexico would have led to the same priority for planning procurement. The effect of the Mexican respondent group is visible in the junior project managers' profile because of the low number of junior participants from Europe. Again, it is speculative if that effect would have been visible if more European junior-level participants had responded. Moreover, there is no statistically significant difference between European and Non-European respondents. Combining the previous arguments and the strong resemblance of European and non-European results suggests these findings are representative, even though primarily Dutch-based.

Statistical tests revealed very few statistically significant differences.⁷ The nature of the question and the profession's broadness created a scattering of answers over the matrix. Therefore, one can discuss the appropriateness of the prioritization question. It limits respondents in their choice of processes. However, the review of competence research showed that, without instruction to select a specific

⁵ The text in this section only reflects the opinions of the experts in the review session. The text was sent to and approved by the participants, with the exception of some grammar changes.

⁶ References added by the researcher, not specifically mentioned in the discussion.

⁷ Even when not applying the necessary Bonferroni correction.

number of important competences, respondents often tend to mark almost everything as important (Nijhuis et al., 2018). Moreover, various respondent groups created comparable results when answering this prioritization question.

Various methods can be used to compare respondent groups. One method considered was comparing the top five priorities without ranking. This method suggested more differences than observed in the method used in this study. However, identifying priorities needs more than a top five. Moreover, not all respondent groups have the same number of priorities. Comparing the ranking of priorities would suggest even more differences. Using a map of priorities offered a more fitting representation and comparison, revealing minor differences and several commonalities.

This study used a cut-off percentage of 150% to identify priority processes to include in the profiles. A higher cut-off percentage, such as 200%, would reduce the number of priority processes, commonalities, and subjects with priority processes. Reducing the number of subjects would limit the representation of the broadness of the profession. Therefore, a higher cut-off value was not appropriate.

The crude chi-square with a 150% cut-off visualized the respondent group's choices of priorities and enabled comparison of respondent groups, as shown in Tables 6–9. The results showed several small groups exhibiting commonalities in their profile. After removing small groups from the analysis, the same effects remained. The consistency between several small samples, as shown in the various comparisons (Tables 6–9 and in Appendix C), provides confidence that the resulting overall profile is a valid representation of practice and not just a random result (See Appendix D).

Finding the right respondent group for research into junior PM competences can be challenging. It is doubtful whether students can determine whether a training course in PM is fit-for-purpose. However, it is usual to investigate the quality of PM education based on student evaluations (E. Nijhuis, 2017). Students with internship experience show differences in opinions on PM teaching necessities compared with recently graduated students who have gained experience (Geelen, 2019). A junior project manager may lack the experience needed for a complete picture. An experienced project manager may have that experience but could lack insight into the current needs of junior project managers. The experts participating in the review session showed similar concerns. The experts suggested trusting the views of students or experienced project managers over those of junior project managers. This study showed that these three respondent groups have similar opinions on the priority processes of the junior project manager (see Table 6). However, the students and the experienced project managers agreed on a priority for implementing integration outside the overall profile.

The survey used a blank ISO matrix instead of a structured list of named processes. A blank matrix permits interpretation by respondents of subjects and stages. Respondents were able to mark cells as a priority without an explicitly identified accompanying ISO process. Initiating scope has no equivalent process in the ISO matrix, yet was chosen as a priority in almost all profiles. Nonetheless, other cells without a connected ISO process were only occasionally considered as a priority by a specific respondent group. Added value, the subject suggested by the focus groups in Nijhuis, 2021, had little effect on the results, rarely including any priority processes across the different stages.

6.2. Overall results

In line with a previous statement on the necessity of a degree (Arras People, 2015), the majority of respondents have a higher education degree. Moreover, Table 2 shows that the group of project managers without a degree became smaller over time, suggesting that a degree may soon be required. Of the students in curricula that teach PM, only 63% reported attention paid to PM theory. Only 54% reported attention paid to practical PM skills — even fewer reported experience with

specified skills like leading groups and knowledge of PM methods (Students in Table 3). Such low numbers add concern to the level of preparedness of students, as highlighted before (Borg et al., 2023; Fioravanti et al., 2019).

6.3. Junior priorities

The juniors' priorities showed some differences (Tables 6, 7 and 9). However, even small respondent groups, like managers of project managers with 13 respondents, showed very few differences from the overall profile, and their profiles were mostly comparable. Hardly any priorities were identified in two subjects by any respondent group: procurement, mainly chosen by junior project managers from Mexico, and added value, only chosen as a priority by respondents having experience with event projects or working in the government sector.

More differences were noted across stages, with respondents having experience with events including three more top-priority processes in the controlling stage than during planning. Planning was the stage with the most priority processes for all the other respondent groups, with options for discussion on where to focus next, mostly between controlling and implementing. A previous exploration of practice in teaching PM criticized the narrow focus on the planning stage (E. Nijhuis, 2017). However, this study countered most of this criticism by finding the planning stage to include the most priority processes. It also countered the preliminary research assumption that priorities for juniors would be more implementing and controlling-oriented when compared to more experienced project managers (A. Nijhuis, 2016).

Implementing is an essential stage for juniors, but there was a difference in priorities between respondent groups when split in experience (Table 1), project type (Table 2), and sectors (Table 3) on which subjects needed priority in implementing. The students and experienced project managers, trusted over the juniors by the expert group, have implementing integration as an extra priority to the overall profile.

6.4. Junior, experienced and senior priorities

At first sight, minor differences appeared between the self-reported proficiency levels junior, experienced, and senior project managers' priority profiles (Table 9). Analysis of experienced and senior priority profiles based on respondents' types of project experience and sector revealed roughly the same variations as for junior project managers (see Appendix C).

However, senior project managers were the only group to give four stages roughly the same weight, when analyzing the profiles based on project type and sector (Tables C3 and C4). The overall profile did not reflect this. Moreover, the priority profiles for experienced and senior project managers (Tables C1 through C4) revealed slightly more differences between them, and even omissions of subjects in the overall profile, such as risk management for experienced project managers. Therefore, senior and experienced overall profiles are not as good a representation of priority processes identified by respondents across project types and sectors as the overall junior profile is.

This study worked with self-defined proficiency levels for project managers. The section on participants showed that these categories somewhat overlap in project experience, PM experience and age, which showed that more variables determine the proficiency level than those measured here. This could offer a first start in defining upward careers in PM. Moreover, this study did not research which level of support the participants received from their organisation, whether this support depended on the proficiency level, nor did it ask for other context variables like project maturity and size of the organisation. Given the similarities reported in this study, it is unlikely that these factors would have affected the outcome.

Earlier findings (Nijhuis et al., 2018) suggested that project type has little influence on what processes have priority. This study partially confirmed this, finding minimal differences based on respondents' types

of project experience between profiles for junior project managers (Table 7) and only slightly more for experienced and senior project managers (Appendix C).

The review session with experts stressed the breadth of PM. The results confirmed this breadth for subjects, since only integration and procurement were found to have few identified priority processes in the detailed analysis. Moreover, respondents almost completely ignored the closing stage as a priority. The experts in the review session acknowledged the latter as a standard practice, stressing the consequences for the continuation of system errors.

Searching the literature for articles on priority processes led to one text reporting on frequently used processes in ICT-related projects (Varajão et al., 2017). They listed all items based on a combination of ISO 21500 and PMBOK (PMI, 2008) for their survey. Planning time (5 items frequently used), planning scope (4), and planning cost (3) were reported as frequently used (score ≥ 2.0 in their Fig. 1, p. 220). Other processes had at most one item frequently used. Several cells in their study contained a frequently used item that was not chosen as a priority, most notably four in integrating (planning, implementing, controlling, and closing) and four in resource management (initiating, implementing, and controlling). Although a high frequency does not equal a priority, their findings support the results in this study, with two or more high-frequency processes identified in almost all subjects and a focus on the planning stage (17) followed by controlling (6).

Very little literature on processes or tasks was found. Previous research was attribute competence prone. The analysis of 30 previous competence studies mapped 93% of 721 used competences on an attribute-based taxonomy (Nijhuis et al., 2018). Using the same mapping methodology for processes, with ISO 21500 as the structure, mapped only 24% of the 721 competences of previous research. Of these mapped competences, 23 were mapped onto a single matrix cell. The rest were either a subject (50) or a stage (9). Like in the previous analysis, there was a strong difference between using important (previous studies) and critical – which in this study translated to choosing a relatively low number of priorities – with a low recognition of stakeholder management as important by previous studies (2 mapped important competences), with resource (14), time (13), and communication (13) scoring much higher in previous research.

Even though higher education should focus on both tasks and underlying competences (Hager, 2017), their focus is primarily on attribute competences (Nijhuis et al., 2018).

6.5. Developing project management competence

The review group hesitated to accept the results as clear guidance for designing higher education PM courses. They criticized the absence of the closing stage, and the apparent lack of consistency. They pleaded for introducing the breadth of PM first.

Combining the results from the survey and the review group provides clues to preparing students in higher education for PM. A majority of the respondents, especially the managers, believed that experience with methods is necessary before starting in a PM job. The experts in the review group supported this. Students need experience with methods – preferably outside the PM course itself. The motivation is to prepare students for discussions about methods that the experts have observed in their practice of PM. Illustrative of a method discussion was a respondent who refused to mark priority processes within the confinement of the ISO matrix, stating that this was too much Waterfall-oriented – a classical PM approach – and not Agile.

This study worked with the assumption that following priorities leads to PM success. The expert reviewers challenged this assumption by pointing to the absence of closing. Still, the priority processes were remarkably robust for junior project managers. Therefore, the overall junior project managers' process priority map offers an accurate description of actual practice. This research provides higher education with a scientific overview of junior project managers' priorities in their

daily work. This daily work as a junior project manager could start soon after graduation, as junior project managers reported a lead time of 2.6 years of project experience, which was only 0.6 years more than students reported.

An educational profile based on this research would consist of the overall profile of juniors with implementing integration added, as chosen by students and experienced project managers and advocated by the review group. This addition also balances the relative weight of implementing and controlling, as seen in the specific analysis of respondent groups, project types, and sectors. This profile provides a close representation of the specific priorities for respondents having experience with any project type except for events. Responses from participants having experience with this latter project type shared most of this profile, with an extra focus on controlling and implementing.

The educational profile would then cover 82% of the priorities identified by respondent groups with different types of PM experience, 80% by project type, and 73% by sector. The overall profiles based on experience (Table 9) provided few clues for project managers' educational training needs when moving from junior to experienced or senior project manager levels. The differences in specific profiles for more mature project managers suggest that their development should focus on specific demands or attribute competence growth.

Higher education prepares students without prior PM experience. However, the bulk of the commercial training aimed at the development of PM is also aimed at people with little or no experience in PM (A. Nijhuis, 2016). Therefore, the results of this study provide an evidence base for commercial training as well. Although no direct link between the education of project managers and project success has been established, one can assume that improper education is not helpful. This study helps in defining the educational needs of starting project managers. It is a first starting point; educational institutes should focus on how to create proper insight for students in these processes, for instance, by using simulation, which is currently hardly used (E. Nijhuis, 2017).

7. Conclusion

This study revolved around priorities in competences for project managers. The findings showed priority process competences for junior, experienced, and senior project managers. The findings also showed a few subjects that the respondents hardly prioritized: added value, procurement, and integration.

Groups with diverse types and levels of project expertise showed considerable commonality in views for junior project managers' priorities. Experience with different project types had almost no relation to priorities, except for the project-type events. Sector-related effects appeared to be stronger but were still limited. The overall profile for juniors needed only slight adaptations based on respondents' experience with different project types or sectors. Compared to junior project managers, the overall profile for experienced and senior project managers was less generic for all project types and sectors.

Although most of the profiles reported here are highly comparable, there is no such thing as a generic priority profile for all project managers.

As the discussion suggested, it is possible to construct a generic educational profile for junior project managers covering most identified priorities. This educational profile would provide a basis for designing a single higher education course on PM. The exploration of current practice (E. Nijhuis, 2017) illustrated that most curricula confined PM to a single course, which dealt with a few subjects. The results of this study provided an evidence-based focus on processes, with a broader range of subjects than the current practice. An analysis of commercial training aimed at starting project managers showed a skewed focus compared to the results of this study (Nijhuis et al., 2018).

If curricula allowed more space than a single module, higher education should look beyond the identified priorities, for example, addressing lessons learned (closing stage) and experience with

contemporary PM methods. Nonetheless, higher education ambitions in preparing for PM should remain realistic; do not expect real experience in managing projects in the curriculum. The experts would like higher education to create value for the profession. This recommendation needs further research.

For juniors, the identified priorities can guide the development of PM competences on top of conveying the breadth of PM. The literature has shown that training can affect prioritization (Gutzwiller and Sitzman, 2017; Raby and Wickens, 1994). Therefore, using the priority profile in training will prepare students for their practice as a junior project manager. However, the results provided no specific directions for continuing development.

Further research should explore whether experience with the event project type is simply an exception for identified priorities for junior project managers or not. Likewise, project types that were not included, such as social work projects or research projects, need further research. Nonetheless, the junior priority profile seems to be applicable in the Dutch context and the wider European and non-European regions. This finding supports global PM competency standards such as ICB4 (International Project Management Association, 2015) and PMP® (Project Management Institute, 2010) for entry-level. However, since only limited evidence is available for this support, further research is advised.

The academic contributions of this study are two-fold. It appears to be the first research into the priorities of project managers, from various viewpoints, showing comparable results. Secondly, this might be the start of an interesting field of research into where the priorities should be.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.plas.2023.100105>.

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