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Role of the Professional Profile Map (PPM) in Modern Education of Civil Engineers

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Abstract. Modern civil engineering education places a strong emphasis on practical skills as well as theoretical knowledge. Practical experiments, laboratory work and actual projects are integrated into the curriculum. This approach ensures that graduates not only understand theoretical principles, but are also able to apply them to practical situations. Industry collaborations and internships further enhance this practical exposure, bridging the gap between academia and the professional sphere. The Professional Profile Map (PPM) assumes a pivotal role in shaping the education of civil engineers, offering a comprehensive framework that steers their academic and professional growth. A primary function of PPM is to assist civil engineering students in identifying the fundamental competencies and knowledge domains crucial for excelling in their profession. It provides a lucid overview of technical skills, which form the bedrock of a civil engineer's expertise. Moreover, the PPM underscores the significance of non-technical skills within a civil engineering education. Competencies like communication, teamwork, problem-solving, and project management are deemed indispensable for civil engineers, given their frequent involvement in interdisciplinary teams and interactions with clients and stakeholders. The map serves as a guiding compass, enlightening students about the pivotal role of these skills and motivating them to cultivate both technical knowledge and these vital interpersonal competencies. The paper examines the role of PPM in Erasmus+ education projects, highlighting the ease of adaptation of this tool according to educational needs. Such an approach is in line with the objectives of the Erasmus+ program encouraging interdisciplinary collaboration, practical experience and employability. A case study from the GREEN ROOFS project illustrates how PPM was used to identify knowledge, skills and competencies related to the implementation of green roofs engineering in construction. The role of PPM in harmonizing educational programs in different countries and promoting international cooperation was emphasized.

Keywords: Professional Profile Map (PPM), civil engineering education, practical skills, green roofs, Erasmus+ projects

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INTRODUCTION

In the dynamic realm of civil engineering, where technological advancements and societal demands constantly reshape the professional landscape, education must evolve to equip future engineers with the skills, knowledge, and adaptability required to thrive. The traditional path of civil engineering education, while foundational, no longer suffices in preparing graduates for the multifaceted challenges of the 21st century. To bridge this gap, a novel

approach emerges - the Professional Profile Map (PPM) [1]. The history of the implementation of the PPM in civil engineering education traces back to a recognition of the evolving demands placed upon the profession in the late 20th and early 21st centuries. As the field expanded beyond traditional infrastructure concerns to encompass sustainability, resilience, and interdisciplinary collaboration, educators and industry leaders recognized the need for a more comprehensive framework to guide the development of future civil engineers.

The initial stages of implementing the PPM involved collaborative efforts among academia, professional organizations, and industry stakeholders to define the core competencies and skills required of modern civil engineers. Drawing upon existing frameworks, such as accreditation criteria and industry standards, these stakeholders identified a broad range of technical proficiencies, soft skills, and ethical considerations essential for success in the field.

Throughout the 2000s, pilot programs and experimental curricular revisions began to integrate elements of the PPM into civil engineering education. These initiatives aimed to provide students with opportunities to develop the identified competencies through project-based learning, interdisciplinary coursework, and experiential learning experiences.

As evidence of the efficacy of the PPM-based approach began to accumulate, momentum grew for broader adoption within the civil engineering education community. Professional organizations, accrediting bodies, and funding agencies began to endorse the framework, providing resources and support for its implementation at institutions nationwide.

By the 2010s, the PPM had become firmly established as a guiding framework for civil engineering education, with many programs incorporating it into their curricula. This period saw the development of standardized assessment tools and benchmarks to measure student proficiency in PPM competencies, as well as the emergence of best practices for integrating PPM principles into various educational contexts.

Today, the implementation of the Professional Profile Map continues to evolve in response to ongoing advances in technology, changes in societal priorities, and emerging trends in the engineering profession. Educators, students, and industry stakeholders remain committed to refining and expanding the framework to ensure that civil engineering education remains relevant, responsive, and aligned with the needs of society [2].

ROLE OF THE PROFESSIONAL PROFILE MAP IN MODERN EDUCATION

The PPM plays a pivotal role in modern education for civil engineers by providing a comprehensive framework to guide the development of students into well-rounded professionals equipped to address the complex challenges of the field.

It also serves as a guiding framework that not only prepares students for the technical aspects of civil engineering but also cultivates the professional skills, ethical values, and global perspectives necessary for success in the field. By integrating the PPM into civil engineering education, institutions can ensure that their graduates are equipped to address the multifaceted challenges of modern engineering practice and make meaningful contributions to society.

Defining Core Competencies

Defining core competencies within the PPM is foundational to its role in modern civil engineering education. These competencies encapsulate the diverse skill set required for success in the field, extending beyond technical proficiency to encompass a holistic array of capabilities essential for navigating the complexities of contemporary engineering practice. Within the PPM, core competencies are meticulously delineated to encompass technical skills, soft skills, ethical considerations, and global perspectives. Technical proficiency encompasses mastery of fundamental engineering principles, advanced analytical techniques, and proficiency in relevant software tools. Soft skills, such as communication, teamwork, leadership, and problem-solving, are recognized as integral to effective collaboration and project management. Ethical considerations underscore the importance of integrity, professionalism, and ethical decision-making in engineering practice, ensuring that graduates uphold the highest standards of ethical conduct in their professional endeavours. Global perspectives emphasize the interconnected nature of engineering challenges and the importance of cultural awareness, environmental stewardship, and social responsibility in addressing them. By defining these core competencies, the PPM provides a comprehensive framework for curriculum development, program assessment, and professional development, ensuring that civil engineering graduates are well-equipped to meet the demands of the profession and contribute meaningfully to society.

Guiding Curriculum Development

Guiding curriculum development within the framework of the PPM is integral to preparing civil engineering students for the multifaceted challenges of the profession. The PPM serves as a strategic blueprint, delineating core competencies that extend beyond traditional technical knowledge to encompass a broad range of skills, including soft skills, ethical considerations, and global perspectives. Curriculum developers leverage the PPM to design educational programs that integrate these competencies throughout the curriculum, ensuring a comprehensive and well-rounded educational experience. Courses are structured to provide students with opportunities to develop and demonstrate proficiency in each aspect of the map, incorporating innovative teaching methods, interdisciplinary coursework, and experiential learning opportunities. By aligning curriculum development with the PPM, educators foster the development of adaptable, socially conscious engineers capable of addressing the complex challenges facing the profession. Furthermore, the PPM serves as a tool for continuous improvement, enabling educators to regularly assess and refine curriculum offerings to meet evolving industry needs and educational standards. Overall, the PPM serves as a guiding framework that empowers educators to design curricula that not only impart technical knowledge but also cultivate the professional skills, ethical values, and global perspectives necessary for success in civil engineering practice.

Promoting Experiential Learning

Promoting experiential learning within the framework of the PPM is paramount to fostering the practical skills and real-world insights essential for success in civil engineering. The PPM recognizes the value of hands-on experiences, such as internships, co-op programs, research projects, educational projects (including Erasmus+ projects) and community engagement initiatives, in complementing theoretical knowledge with practical application. Educators leverage the PPM to integrate experiential learning opportunities throughout the curriculum, providing students with opportunities to apply their learning in authentic contexts, collaborate with industry professionals, and tackle real-world engineering challenges. These experiences not only enhance technical proficiency but also cultivate soft skills, such as teamwork, communication, problem-solving, and leadership, which are critical for effective engineering practice. By engaging in experiential learning, students gain invaluable insights into the complexities of engineering projects, develop professional networks, and acquire the confidence and resilience needed to navigate the dynamic landscape of the profession. Furthermore, experiential learning experiences foster a deeper understanding of ethical considerations, social responsibility, and sustainability, empowering students to make informed decisions and contribute positively to society. Overall, promoting experiential learning within the PPM framework enriches civil engineering education, equipping graduates with the practical skills, ethical values, and global perspectives necessary to excel in their careers and make meaningful contributions to the field.

Facilitating Interdisciplinary Learning

Facilitating interdisciplinary learning within the framework of the PPM is pivotal to preparing civil engineering students for the increasingly complex and interconnected challenges they will face in their careers. Recognizing that modern engineering challenges often transcend traditional disciplinary boundaries, the PPM advocates for the integration of diverse perspectives and expertise into the educational experience. Through interdisciplinary coursework, collaborative projects, and cross-disciplinary research opportunities, students are encouraged to explore the intersections between civil engineering and other fields such as architecture, environmental science, urban planning, and public policy. By engaging with professionals and scholars from diverse backgrounds, students gain a deeper understanding of the multifaceted nature of real-world problems and develop the skills needed to collaborate effectively across disciplines. Interdisciplinary learning not only enhances students' problem-solving abilities but also fosters creativity, innovation, and adaptability—qualities that are essential for addressing the complex challenges of the 21st century. Moreover, by incorporating interdisciplinary perspectives into the curriculum, the PPM ensures that civil engineering graduates are well-equipped to navigate the dynamic and ever-evolving landscape of the profession, and to make meaningful contributions to society by addressing the most pressing global challenges.

Supporting Professional Development

Supporting professional development is paramount to ensuring that civil engineering graduates continue to grow and thrive throughout their careers. The PPM recognizes that learning does not end with graduation but is instead an ongoing process that requires continuous development and refinement of skills and knowledge. To support professional development, the PPM provides a roadmap for lifelong learning and growth, outlining core competencies that civil engineers should strive to cultivate throughout their careers. This includes technical skills, such as staying abreast of advances in engineering technology and methodologies, as well as soft skills, such as communication, leadership, and teamwork. Additionally, the PPM emphasizes the importance of ethical considerations, social responsibility, and global perspectives in engineering practice, encouraging engineers to engage in activities that promote ethical decision-making, community engagement, and sustainability. Furthermore, the PPM serves as a guide for identifying professional development opportunities, such as continuing education courses, professional certifications, and networking events, that can help engineers enhance their skills, expand their knowledge, and advance their careers. By supporting professional development, the PPM ensures that civil engineers remain competitive, adaptable, and well-equipped to address the evolving challenges of the profession, and to make meaningful contributions to society throughout their careers.

Fostering Ethical and Social Responsibility

Fostering ethical and social responsibility within the framework of the PPM is fundamental to shaping civil engineers who are not only technically proficient but also committed to upholding the highest standards of integrity and contributing positively to society. The PPM recognizes that civil engineering projects have far-reaching impacts on communities, the environment, and future generations, and therefore emphasizes the importance of ethical decision-making, social consciousness, and sustainability in engineering practice. By integrating ethical considerations into the curriculum, the PPM encourages students to critically examine the ethical dimensions of engineering projects, consider the potential consequences of their actions, and make principled decisions that prioritize the well-being of stakeholders and the public good. Moreover, the PPM underscores the importance of social responsibility, urging engineers to engage with communities, address societal needs, and advocate for equity and justice in their work. Through coursework, projects, and experiential learning opportunities, students are exposed to real-world ethical dilemmas and social challenges, empowering them to develop the moral compass and empathy needed to navigate the complexities of engineering practice responsibly. Furthermore, by instilling a commitment to ethical and social responsibility, the PPM equips civil engineers with the moral courage and leadership skills to effect positive change in society and contribute to a more sustainable and equitable future for all.

Aligning with Industry Expectations

Aligning with industry expectations is crucial to ensuring that civil engineering education remains relevant and responsive to the needs of the profession. The PPM recognizes that the field of civil engineering is constantly evolving, driven by technological advancements, changing regulatory landscapes, and shifting societal priorities. To stay abreast of these developments, the PPM incorporates input from industry stakeholders, including employers, professional organizations, and regulatory bodies, to identify the skills, knowledge, and competencies that are most valued in the workforce. By aligning educational outcomes with industry expectations, the PPM ensures that graduates are well-prepared to meet the demands of the profession and contribute effectively to their organizations from day one. This alignment is achieved through various mechanisms, including regular review and revision of curricula to incorporate emerging trends and technologies, collaboration with industry partners to develop experiential learning opportunities and internships, and engagement with professional organizations to ensure that educational programs meet accreditation standards and industry benchmarks. By fostering close collaboration between academia and industry, the PPM ensures that civil engineering education remains dynamic, responsive, and closely aligned with the evolving needs of the profession, ultimately benefiting both students and employers alike.

ROLE OF THE PROFESSIONAL PROFILE MAP IN ERASMUS+ PROJECTS

The PPM serves as a guiding framework in Erasmus+ education projects, providing a structured approach to curriculum development, implementation, and evaluation. Erasmus+ projects often involve collaboration between

institutions across different countries and aim to promote innovation, cooperation, and excellence in education and training [3]. The PPM offers a standardized set of competencies and learning outcomes that align with the needs of the civil engineering profession, ensuring consistency and coherence across diverse educational contexts. By incorporating the PPM into Erasmus+ projects, educators can design curricula that address the multifaceted skill sets required for modern engineering practice, including technical proficiency, soft skills, ethical considerations, and global perspectives. Moreover, the PPM facilitates the recognition and validation of learning outcomes achieved through Erasmus+ mobility activities, enabling students to demonstrate their competencies and skills in a standardized manner across borders. Additionally, the PPM serves as a tool for quality assurance and continuous improvement, allowing project partners to assess the effectiveness of their educational interventions and make informed decisions for future iterations. Overall, the PPM plays a crucial role in enhancing the quality, relevance, and impact of Erasmus+ education projects in civil engineering by providing a common framework for curriculum design, implementation, and assessment that fosters student mobility, employability, and lifelong learning.

A Case Study from The Green Roofs Project

The GREEN ROOFS project, funded by the Erasmus+ program, aimed to promote sustainable construction practices by integrating green roofs into building design and construction. Central to the project's success was the utilization of the Professional Profile Map to identify the knowledge, skills, and competencies required for the effective implementation of green roofs engineering [4].

The project team began by mapping out the key competencies and learning outcomes associated with green roofs engineering using the PPM as a guide. Drawing upon existing frameworks, such as industry standards, best practices, and academic curricula, the team identified a comprehensive set of knowledge areas, technical skills, and soft skills essential for success in the field. These included:

- Knowledge of green roofs technology: Understanding the principles, components, and benefits of green roofs, as well as their environmental and economic implications.
- Technical skills in green roofs design and construction: Proficiency in site assessment, structural analysis, waterproofing, drainage, planting techniques, and irrigation systems.
- Soft skills in interdisciplinary collaboration: Ability to communicate effectively with stakeholders, coordinate project teams, and integrate input from multiple disciplines.
- Ethical considerations and sustainability: Awareness of ethical issues related to green roofs implementation, such as environmental impact, resource use, and social equity.

As part of the GREEN ROOFS project, a series of training workshops and online courses were developed based on the identified competencies. These educational resources cover topics ranging from green roofs design principles and construction techniques to project management and stakeholder engagement. Through hands-on activities, case studies, and interactive simulations, participants will gain practical experience and applied their learning to real-world scenarios. Moreover, the project facilitated networking opportunities and knowledge exchange among professionals, researchers, and educators, fostering a collaborative learning environment that transcended disciplinary boundaries.

The integration of the Professional Profile Map into the GREEN ROOFS project ensured that educational interventions were aligned with industry expectations and best practices. By providing professionals with the knowledge, skills, and competencies needed to implement green roofs effectively, the project will contribute to the widespread adoption of sustainable construction practices and the advancement of green infrastructure initiatives. Moreover, the project's emphasis on interdisciplinary collaboration and ethical considerations underscored the importance of holistic approaches to engineering education and practice.

CONCLUDING REMARKS

In conclusion, the Professional Profile Map serves as a transformative tool in modern civil engineering education, guiding students towards a well-rounded professional development. By emphasizing a balance between technical expertise and essential non-technical skills, the PPM equips future engineers to navigate the complex challenges of the 21st century. Through industry collaborations, ethical considerations, interdisciplinary learning, and support for ongoing professional development, the PPM ensures that civil engineering graduates are not only technically proficient but also socially responsible and adaptable professionals. As the field continues to evolve, the

PPM remains instrumental in shaping the education of civil engineers, aligning with industry expectations and fostering a commitment to excellence, ethics, and societal impact.

The GREEN ROOFS project exemplifies how the Professional Profile Map can be leveraged to identify and address the knowledge, skills, and competencies required for the successful implementation of green roofs engineering in construction. By integrating the PPM into educational initiatives, projects like GREEN ROOFS can empower professionals to meet the challenges of sustainable development and contribute to a more resilient and environmentally conscious built environment.

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