Science Education International
36(4)_2025,503-509
https://doi.org/10.33828/sei.v36.i4.13

ORIGINAL ARTICLE

The Effect of Job Shadowing Practices on Science Teachers' Career Perceptions

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ABSTRACT

This study, conducted within the scope of the acaSTEMy project supported by the European Union's Erasmus Plus Programme, is a mixed-methods research that aims to develop the career awareness of pre-service science teachers and in-service teachers through a learning process based on job shadowing. With the participation of a total of 20 undergraduate and graduate students from Dokuz Eylül University, field observations were carried out across six different institutions, ranging from industrial organizations to technoparks and research centers. The main findings of the study indicate that the job shadowing experience had a significant and strong effect on the participants' professional identities and Science, Technology, Engineering, and Mathematics career visions. According to the quantitative data obtained from the acaSTEMy Survey, the overall experience and the increase in career awareness point to a notably high level of satisfaction. These results played a decisive role in participants' re-evaluation of their pedagogical approaches, as they experienced firsthand that the field of science education has concrete applications in institutional and scientific contexts beyond schools. The study offers recommendations for the wider dissemination of such practices.

KEY WORDS: Job shadowing, professional development, science education

INTRODUCTION

In recent years, science education has increasingly emphasized the need for teachers to develop competencies that extend beyond classroom-based instruction, including awareness of interdisciplinary Science, Technology, Engineering, and Mathematics (STEM) career pathways and the ability to connect scientific knowledge with real-world professional contexts. However, despite receiving STEM-oriented training, many pre-service and in-service science teachers have limited opportunities to observe how scientific knowledge is applied across different sectors such as industry, research centers, and innovation ecosystems. Job shadowing, as an experiential learning approach, offers a structured means of addressing this gap by enabling participants to observe professional practices directly, engage with organizational cultures, and reflect on diverse career possibilities. Within this framework, the present study examines the effects of job shadowing practices implemented as part of the Erasmus+-supported acaSTEMy project on the career perceptions and professional awareness of pre-service science teachers and postgraduate students. Using a mixed-methods design, the study aims to contribute empirical evidence on the role of job shadowing in broadening STEM career perspectives and supporting professional identity development in science teacher education.

AcaSTEMY Project

The acaSTEMy project is supported by the European Union's (EU) Erasmus+ Programme and involves nine universities from different European countries, including Dokuz Eylül University. The acaSTEMy project focuses on teachers, who play a key role in educating generations with the multifaceted skills required for green and digital transformations. Due to teachers reporting gaps in their digital skills, mobility, and mentoring, the project aims to develop a systematic support structure for high-quality, research-based STEM teacher training.

The acaSTEMy project falls under the Erasmus+ Teacher Academies program. This program was created to establish European partnerships to develop and test innovative teacher training. Its focus areas are initial and continuous professional development through mobility and collaborative learning opportunities, addressing EU priorities such as digital skills, sustainability, equality, and inclusivity. The aim is to build strong networks and improve teacher training policies and practices across Europe.

Literature Review

According to Cho and Gao (2009), job shadowing is a concept that refers to the opportunity for an individual to directly observe a professional performing their duties in the workplace. According to a study by Rony et al. (2019), job shadowing is defined as an opportunity for students to accompany an experienced employee while they perform their targeted job, allowing them to experience what it is like to do a particular job, usually through a collaboration between a business and an educational institution. From a broader

perspective, it significantly contributes to and holds potential for the career orientation and professional development of individuals pursuing their education by enabling them to gain critical awareness of potential career fields while still in their student years. This method supports the individual's professional maturation by strengthening the bridge between theoretical knowledge and the business world.

Experiential programs enable students to explore various career options, network, and work with both academic and professional mentors (McCarthy and McCarthy, 2006). In this respect, they contribute to students consciously shaping their career orientation. When university students want to experience the work they will do after graduation in advance, universities can often provide this through internship opportunities. However, as an alternative to these programs, which are generally short-term, limited in scope, and planned toward the end of the education and training process, the importance of different mechanisms that offer an earlier and more holistic perspective on the business world is increasing. It is observed that students studying in STEM fields, which constitute an important example of experience-based programs, are not exposed to such experiences at a sufficient level and in a systematic manner. As Visco et al. (2022) point out, most students enter STEM majors with very little knowledge of what a career in their chosen field entails. This can lead to a significant mismatch between students' career expectations and the actual requirements of the business world. As Mamlok-Naaman et al. (2025) emphasize, job shadowing is an effective method for discovering potential career aspirations, particularly in STEM fields, as it provides individuals with first-hand experiences that allow them to observe and evaluate their theoretical knowledge within real professional contexts. Sanders (2008) defines science, mathematics, and technology teachers as STEM educators working in STEM education. Within this framework, a similar situation applies to science teachers who have received a STEM-based undergraduate education.

Despite being exposed to extensive STEM-related coursework, particularly at the university level, science teachers often have limited opportunities during their training to observe how this theoretical knowledge is concretely connected to other disciplines and institutional practices in real-world settings. As a result, they may struggle to fully recognize the expanding application areas of the teaching profession. This deficiency creates a gap in the active use of acquired knowledge and in the development of a vision for multidisciplinary working environments among teacher candidates. Discovering opportunities to work in an institution other than the schools and faculty of education where they complete their internships enables teacher candidates to deepen their understanding of the field-specific application of the knowledge they have acquired, thereby increasing their opportunities for institutional and sectoral experience. This study included not only science teacher candidates but also postgraduate students who are actively teaching. This participation supports the view emphasised by Hanuscin et al. (2021) that the teacher training process should not be seen merely as a pre-graduation stage, but rather that professional learning should be approached as a process that continues throughout a person's career.

This article aims to develop the career awareness of pre-service science teachers and science teachers through a job shadowing-based learning process within the scope of the acaSTEMY project. The study aims to help participants recognze the multidimensional and diverse career opportunities available in the field of science education, beyond simply teaching in an educational institution. Thus, it is intended that teacher candidates and teachers develop a broader career perspective by experiencing interdisciplinary working environments, field-based research processes, and the competencies required for different professional roles.

METHODOLOGY

Participants

This study was conducted with the participation of a total of 20 students enrolled in undergraduate and graduate programs. The participant group consisted of four 2nd-year, three 3rd-year, and seven 4th-year undergraduate students, as well as six master's students at the graduate level.

Material

As a created part of the acaSTEMy project, three different forms were administered online to participants during and after the career observation activity. These were: The Learning Diary Form, the Checklist Form, and the acaSTEMy Survey.

RESULTS

The job shadowing event, organized over 3 days at six different organizations, produced multi-dimensional outputs regarding participants' perspectives on professional awareness, career perception, technology use, and work processes. Over the course of 3 days, participants were asked to complete a Learning Diary Form and a Checklist Form each day. The findings from each visit are provided below. Furthermore, after the event was completed, participants were asked to indicate their experiences from this event by completing the acaSTEMy Survey. The findings obtained are outlined below.

Day 1

On November 11, the participants conducted their initial job shadowing visits at Yanmar Turkey Machinery Inc. and Ekoten Textile Industry and Trade Inc.

During the visit to Yanmar Turkey Machinery Inc., the participants had the opportunity to engage in direct communication with company employees. First, the company managers provided an overview of the organization, discussed its collaborations with partners in India and Japan, and presented information about the tractors manufactured by the company. In addition, they offered guidance on how to prepare an accurate and effective curriculum vitae for candidates

considering a career at the company. Subsequently, the participants toured the production facilities, where all stages of the manufacturing process, from the initial phase to the final output, were demonstrated in detail. The workflow monitoring and inspection procedures carried out in this section were also explained comprehensively.

During the visit to Ekoten Textile Industry and Trade Inc., first of all, the participants received a comprehensive presentation on Ekoten's founding history, corporate values, brand portfolio, young talent programs, and production range. Then, the participants proceeded to the production facilities, where they closely observed the process through which a fabric is customized and manufactured in accordance with customer requirements. Throughout this process, the participants were provided with detailed explanations of the stages involved, including fabric weaving, achieving the appropriate color in laboratories and conducting light tests, the application of chemical treatments during production, and the customization of fabrics based on the type of garment.

An analysis of the participants' responses to the forms administered at the end of the day revealed the following views regarding the job shadowing activities conducted on Day 1. The job shadowing visits to Yanmar and Ekoten enabled participants to perceive these companies as systematic, technologically advanced organizations that prioritize sustainable production and employ professional staff who are open to collaboration. Participants were particularly interested in large-scale production processes (e.g., tractor and fabric manufacturing), cultural approaches such as the Hanasaka philosophy, presentations on CV preparation, and innovative practices such as error detection using artificial intelligence. Overall, the experience was described as "useful" and "valuable" in terms of career planning, as it made a significant contribution to students' opportunities to engage with real work environments and to develop an interdisciplinary perspective. Moreover, the experience highlighted that career options in science education are not limited to schools; rather, participants recognized that scientific knowledge can also be applied in areas such as corporate training units, sustainability projects, and professional roles within industry. This realization broadened their professional perspectives and diversified their career aspirations.

Day 2

On November 12, the participants conducted their second job shadowing visits at Dokuz Eylül University Technopark (DEPARK) and the Institute of Marine Sciences and Technology, as well as its research vessel.

During the visit to DEPARK, the participants were first provided with detailed information about the functions of the technopark and the support mechanisms available to students. In this context, the support offered for project funding services, guidance on patenting and registration processes, research and development, and university–industry collaborations, access to investor networks, as well as training, mentoring, seminars, and "I Have An Idea" initiatives aimed at transforming ideas into start-up companies was explained. Following this briefing, site visits were conducted to three companies established within the technopark. Through these visits, the participants gained insights into the operational processes of companies employing container tracking systems, artificial intelligence, and advanced technologies.

As part of the visit to the Institute of Marine Sciences and Technology and its research vessel, faculty members presented the institute's graduate programs and projects to the participants. Subsequently, significant materials retrieved from underwater environments were introduced in the institute's laboratories, and the laboratory working conditions were demonstrated. Finally, the participants visited the institute's research vessel, where they had the opportunity to observe first-hand the research activities conducted on board as well as the instruments used in underwater studies.

An analysis of the participants' responses to the forms administered at the end of the day revealed the following perspectives regarding the job shadowing activities conducted on Day 2. DEPARK was perceived as a fresh, modern, and innovative entrepreneurship center, while the Institute of Marine Sciences and Technology and its research vessel were regarded as disciplined and inspiring scientific research environments. Expert, warm, and collaborative staff at both institutions were positively received by the participants. Topics such as artificial intelligence, technology, marine research, archaeological studies, and ecosystem research captured participants' interest, enabling them to recognize that career options in science education extend beyond schools to include corporate training units, technopark ventures, and research institutions. For some participants, pursuing a master's degree at the institute of marine sciences became an attractive prospect. Through this experience, participants indicated that they aim to bring project-based learning, entrepreneurship, and technology integration approaches into their classrooms to foster interdisciplinary and innovative perspectives among their students. These visits demonstrated that scientific knowledge can be applied not only in academic settings but also in entrepreneurship ecosystems and advanced research vessels, significantly broadening the participants' career vision. In particular, the opportunity to observe real-world applications reinforced their goal of cultivating interdisciplinary and innovative thinking in their students and guided their professional development.

Day 3

On November 13, the participants conducted their third job shadowing visits at Bahçeşehir College Science and Technology High School and Dokuz Eylül University Earthquake Research Center (DAUM).

Bahçeşehir Science and Technology High School differs from other Bahçeşehir Colleges by adopting a project-based, production-oriented, and technology-focused educational model that places STEM education at its core. Supported

by advanced laboratory facilities, the school emphasizes experiential learning through hands-on practices rather than rote memorization. During the visit to this organization, the participants were first provided with detailed information by the school principal and vice principal, followed by presentations from students regarding the school's operations, social clubs, competitions they participated in, implemented social responsibility projects, student achievements, and the resources provided by the school. In addition, the students explained how, beyond the facilities offered, they independently secured investors and coordinated their own projects and clubs.

During the visit to the DAUM Center, university professors provided the participants with information on earthquake formation, seismic zones, fault lines in İzmir, and their effects. In addition, recent earthquakes were examined in detail, and the roles and responsibilities of an earthquake expert were explained.

An analysis of the participants' responses to the forms administered at the end of the day revealed the following perspectives regarding the job shadowing activities conducted on Day 3. Bahçeşehir College Science and Technology High School was perceived as an innovative, technology-oriented educational environment, while the DAUM was regarded as an academically rigorous and socially impactful research setting. Competent, motivated, and collaborative staff and students at both institutions demonstrated strong coordination. This experience heightened participants' interest in the socially beneficial applications of scientific knowledge and diversified their career perspectives in science education, reinforcing their goal of transferring earthquake awareness, STEM, and project-based learning approaches to their students. In particular, the observation of disaster awareness education at the Earthquake Research Center and the engagement of productive students in robotics projects such as FRC/FLL at Bahçeşehir College broadened the participants' horizons. These visits illustrated that a career in science education extends beyond the classroom, encompassing opportunities such as specialization in university research centers or leadership in technology-focused high schools. Participants were motivated to implement these interdisciplinary and project-based approaches in their own classrooms to enhance students' scientific awareness and foster innovation skills.

Learning Diary Form

Learning diary form results detail the frequencies of participants' open-ended responses across the 3 days of the job-shadowing experience, totaling 293 responses. The analysis reveals that the most frequently cited interesting aspect was Career/HR/Development, indicating a strong participant focus on professional growth, followed by themes related to Technology/Artificial Intelligence - Environment/ Sustainability. In terms of utility, the highest frequency of responses pointed to career development/CV preparation, underscoring the perceived value of the experience for personal career planning. This is consistent with where the highest frequency was observed in new ideas about different career paths/diversity, suggesting the program effectively broadened professional perspectives. Furthermore, the high frequency of the response "Nothing Boring" to the query regarding unnecessary aspects suggests that majority of the content and activities were deemed relevant and essential. Finally, the overall feedback in the "Anything you would like to add?" section was predominantly positive feedback/satisfaction.

Table 1: acaSTEMy survey results table

Category	Question item	Average response
Experience during job shadowing (R1)	General experience (R1)	5.82
	R1.1 enjoyed	5.53
	R1.2 was bored	1.24
	R1.3 was relaxed/calm	5.18
	R1.4 was frustrated	1.12
Feelings after job shadowing (R2)	General experience (R2)	5.47
	R2.1 joyful	5.47
	R2.2 sad	1.35
	R2.3 hopeful	5.29
	R2.4 anxious	2.29
	R2.5 proud	5.06
	R2.6 ashamed	1.53
	R2.7 grateful	5.29
	R2.8 disappointed	1.59
	R2.9 relieved	4.53
	R2.10 hopeless	1.88
Project management and suggestions (S1)	Recommendation level (S1 general)	5.82
	S1.1 Clear tasks and goals were defined	5.59
	S1.2 Expectations were communicated	5.88
	S1.3 Commitment to capacity building	5.65
	S1.4 Opinions were considered	5.76
	S1.5 Genuine interest was shown	5.82
Awareness increase (E1)	Awareness Increase (E1 General)	5.76
	E1.1 Jobs related to STEM	5.59
	E1.2 Skills that school systems need to develop	5.65
	E1.3 General objectives of organizations	5.59
	E1.4 Working environments	5.53
	E1.5 Observed career paths	5.59
Career impact (E2, E3)	STEM has increased career interest (E2)	5.35
	E3.1 Changed attitude towards work	5.18
	E3.2 Evaluating teaching skills	5.71
	E3.3 Made me reflect on my goal of teaching career	5.65
	E3.4 Evaluate the working environment	5.59
	E3.5 Evaluate career/future plans	5.47

Checklist Form

Checklist form results detail the frequencies of participants' observations and perceptions across the three job-shadowing days, with a total of 1281 recorded entries. The analysis of the observed jobs revealed that manufacturing was the most frequently observed sector, followed by Marine Sciences. Correspondingly, the tasks observed were predominantly centered on research/development duties and scientific/

academic tasks. The skills deemed necessary for these jobs highlighted the importance of technical/professional knowledge, problem solving, and analytical thinking.

In terms of technology, computers, software, and coding represented the highest frequency of use, followed by measurement and laboratory equipment. The required educational background for the observed positions was most frequently reported as engineering. Regarding necessary support and training, the highest frequency was observed for technological and digital skills.

The primary challenges professionals seemed to face were operational/management challenges and quality/technical challenges. The most frequently identified missions and visions of the organisations are centered on innovation, technology, and development. Participants' perceptions of the workplace environment were equally divided between the themes of order and discipline. Collaboration among colleagues was primarily characterized by clear task distribution and areas of expertise.

Overall, the job-shadowing experience attracted strong interest from participants, as the majority of responses clustered in the "Generally Yes" and "High Interest" categories, indicating a broadly positive level of engagement. The experience profoundly impacted participants' future thinking, with the highest frequencies recorded for the categories, the power of science/technology/education, and organizational skills/management practices.

acaSTEMy Survey

After the completion of the job shadowing activities, participants were asked to complete the acaSTEMy survey. In this survey, where 1 indicated the lowest and 6 the highest rating, participants' responses regarding general impressions of the job shadowing, overall satisfaction with the activity, and the perceived effectiveness of the job shadowing are presented in detail in Table 1.

An examination of Table 1 indicates that the job shadowing experience had statistically significant and strongly positive effects on participants' experiences and career perceptions. The mean score for participants' general experience during the job shadowing activity (5.82), together with the mean score for feelings after job shadowing (5.47), reflects a level of satisfaction close to the upper limit of the six-point Likert scale. This positive perception is primarily driven by high mean scores for affective responses such as "joyful," "grateful," and "hopeful," whereas negative emotions such as "disappointment" and "ashamed" were reported at minimal levels. Participants' evaluations of project management and

Job shadowing in the framework of acaSTEMy project

Model	Job Shadowing	Job Shadowing	Job Shadowing
Examples	**Day 1** **11 November 2025** - YANMAR Turkey Machinery Inc. - Ekoten Textile Industry and Trade Inc.	**Day 2** **12 November 2025** - Dokuz Eylul University Technopark - Institute of Marine Sciences and Technology and Research Vessel	**Day 3** **13 November 2025** - Bahçeşehir College Science and Technology High School - Dokuz Eylul University Earthquake Research Center
Participants	- Pre Service Science Teachers - Master Students in Science Education	- Pre Service Science Teachers - Master Students in Science Education	- Pre Service Science Teachers - Master Students in Science Education
Impact	- Increasing awareness of science-related career opportunities in industrial and corporate settings - Strengthening understanding of how scientific knowledge is applied in large-scale production and quality control processes - Enhancing motivation toward interdisciplinary STEM applications and sustainability-oriented practices - Encouraging participants to reconsider career pathways in industry, corporate training, and applied STEM fields	- Broadening participants' perspectives on research-based and innovation-driven STEM careers - Increasing awareness of project-based learning, technology integration, and interdisciplinary collaboration - Supporting informed career decision-making related to graduate studies and research institutions - Encouraging the transfer of research-oriented and inquiry-based approaches into science teaching practices	- Enhancing understanding of the societal role of science education and scientific expertise - Strengthening awareness of science teachers' potential roles in research centers, disaster education, and technology-focused schools - Encouraging positive attitudes toward STEM leadership, project-based learning, and innovation in education - Expanding participants' career visions toward socially responsive and research-informed educational pathways

Figure 1: Different aspects of the project

organizational processes further confirm that the activity was implemented to a high standard. Most notably, high mean values were observed in the dimensions related to increased awareness of the academic purpose of the activity and its perceived impact on career development. Overall, these findings strongly support the conclusion that the job shadowing experience played a decisive role in enabling pre-service and in-service science teachers to reassess their professional identities, their visions of STEM career pathways, and their pedagogical approaches.

The findings derived from participants' responses offer three main recommendations for enhancing the future potential of the job shadowing program. First, in light of the high level of participant satisfaction, it is recommended that such initiatives be expanded, their organizational sustainability be ensured, and their content be further enriched to deepen the outcomes achieved. Second, to support more informed career decision-making, it is suggested that the scope of the program be diversified to include a wider range of sectors within the field of science. Finally, to contribute to career guidance at an earlier stage, the importance of offering the program to senior high school students is emphasized, along with the need for universities to more systematically promote support mechanisms – such as technoparks – to all faculties and departments.

DISCUSSION AND CONCLUSION

Based on the data obtained within the scope of this research, it has been determined that the "job shadowing" method, which goes beyond traditional models in teacher training processes, has a transformative effect on the professional identity construction and career visions of pre-service science teachers and postgraduate students. Implemented through the acaSTEMy project, this model has provided participants with first-hand experience that science knowledge is not limited to the school environment; it has concrete applications across a wide and diverse range of fields, from industry to technology parks, marine research to disaster management centres.

Visits to various industrial organizations, such as Yanmar Turkey and Ekoten Textile, during the activity made visible the critical role of science education in corporate training units, sustainability initiatives, and high-technology-oriented production processes. Similarly, observations conducted at DEPARK and the Institute of Marine Sciences and Technology enhanced participants' awareness of the entrepreneurship ecosystem and advanced scientific research practices, allowing them to frame their career goals from a multidimensional perspective. Experiences at Bahçeşehir College Science and Technology High School and the Earthquake Research Center further reinforced the potential of scientific knowledge to be transformed into social benefit and innovative projects, concretely demonstrating that pre-service teachers can assume roles not only as transmitters of knowledge but also as technology-oriented leaders and domain experts.

When the results of the acaSTEMy survey are examined within the context of quantitative data, the job shadowing experience is found to have statistically significant and highly positive effects on participants' experiences and career perceptions. The high overall mean score of 5.82 on a six-point Likert scale confirms that the program met participants' expectations and made a strategic contribution to their professional development. The dominance of positive affective responses, such as enjoyment, joyfulness, and hopefulness, together with the minimal occurrence of negative emotions, underscores the effectiveness of field-based practices in enhancing pre-service teachers' professional motivation. Furthermore, the increased awareness of STEM career pathways and the high mean scores related to the evaluation of teaching skills highlight the role of job shadowing in broadening participants' pedagogical visions. Figure 1. illustrates the different aspects of the project.

In a final evaluation, this study, conducted within the scope of the acaSTEMy project, offers an original contribution to the teacher education literature by integrating the theoretical framework of science education with the practical realities of the professional world. Job shadowing is conceptualized not simply as a passive observational activity, but as a paradigm shift that enables pre-service teachers to position themselves as competent individuals capable of leading societal and economic transformations. The high levels of satisfaction and awareness identified in the findings demonstrate that cross-sector collaboration and the integration of out-of-school learning environments into teacher education curricula are not optional preferences, but essential requirements for professional adaptability. Overall, the results indicate that job shadowing makes a meaningful contribution to the professional development processes of both pre-service and graduate teachers. Sustaining the model established through this study has the potential to expand science teaching beyond classroom boundaries, opening broad career pathways that extend from university research centers to high-technology industries. This visionary approach encourages the systematic incorporation of practice-based models into national teacher education policies, thereby enhancing the innovation and entrepreneurship capacities of both teachers and the future generations they educate, and redefining on a scientific basis the inseparable relationship between science education, societal well-being, and technological advancement.

RECOMMENDATIONS

The analysis of participants' responses to the data collection instruments led to the following recommendations:

- The number of such projects, as well as the diversity and size of participant groups, should be increased to broaden their impact and reach.
- The scope of activities should be expanded to include a wider range of sectors, enabling participants to make more informed and realistic career decisions.
- These initiatives should be extended to different age groups, and universities should systematically integrate institutional support structures – such as technology parks

and research and innovation centers – across all faculties and departments to strengthen career-oriented learning opportunities.

ACKNOWLEDGMENTS

This study was funded by the EU under the project *Trans-national STEM Teacher Education Focusing on Transversal Competence and Sustainability Education* (Project Acronym: acaSTEMy, Reference Number: 101104631).

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