

Optimization and Development of an Academic Advising System for Transportation-Related Programs Oriented toward International Employability under the OBE Framework

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Abstract

Global interconnectivity in transportation infrastructure, the digitalization of transport operations, and the green transition require graduates of transportation-related programs not only to master disciplinary knowledge but also to transfer knowledge and solve problems collaboratively across national standards, intercultural teams, and complex engineering contexts. To address the current emphasis of academic advising on course selection and information about further study and employment, as well as fragmented international content, insufficient practice settings, and limited evaluation evidence, this study establishes international employability as the core intended outcome of academic advising. Following the backward-design logic of Outcome-Based Education (OBE), it develops a six-dimensional outcome framework comprising international professional and engineering practice, digital intelligence and innovation, international communication, intercultural collaboration and project management, sustainable development and professional ethics, and career adaptability and lifelong learning. On this basis, the study proposes a staged advising content pathway, a collaborative on- and off-campus practice platform, multi-stakeholder evidence-based evaluation, and a continuous improvement mechanism. The proposed system translates an abstract international perspective into learnable, demonstrable, assessable, and improvable outcomes, providing a pathway for transportation-related programs to strengthen the international relevance of talent development and graduates' career resilience.

Keywords: Outcome-Based Education (OBE); international employability; transportation-related programs; academic advising; continuous improvement.

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I. Introduction

Outcome-Based Education (OBE) begins with what students should be able to accomplish successfully after completing their learning and organizes educational objectives, learning activities, and assessment evidence accordingly. Mitchell and Spady were among the first to discuss the organizational conditions required to implement OBE [1]. Spady further argued that an educational system should be designed holistically around the key outcomes that students can demonstrate at the end of learning [2]. Biggs and Tang's principle of constructive alignment likewise requires consistency among intended outcomes, teaching and learning activities, and assessment tasks [3]. Chinese scholarship has also emphasized that OBE is not simply a matter of quantification or terminology; its essence lies in clarifying outcomes, providing opportunities for attainment, and continuously improving education on the basis of evidence [4, 5]. This logic closely corresponds to the role of academic advising in helping students set goals, choose pathways, integrate resources, and reflect on their development.

Against the backdrop of China's development as a leading transportation nation, international capacity cooperation, and the digital and low-carbon transformation of global transportation systems, graduates of transportation-related programs now encounter occupational contexts that extend beyond individual organizations and local rules. In this study, international employability does not mean the probability of obtaining a position abroad, nor is it measured solely by the number of students who go overseas. Rather, it refers to students' integrated capacity to identify opportunities, perform effectively, transfer their capabilities, and continue developing in international or multicultural work environments. Harvey maintained that employability assessment should focus on the educational process and its improvement rather than simply

attributing employment outcomes to individuals [6]. Fugate et al. conceptualized employability as a combination of career identity, personal adaptability, and social and human capital [7]. Van der Heijde and Van der Heijden operationalized it through occupational expertise, anticipation and optimization, personal flexibility, corporate sense, and balance [8]. Academic advising must therefore evolve from providing information to fostering international employability.

Accordingly, this study addresses three interrelated questions: What observable outcomes should transportation students develop for international occupational contexts? Why does current academic advising fail to support these outcomes effectively? How can an implementable, assessable, and continuously improvable advising system be developed according to OBE principles? Using normative analysis and an integrative review of the literature, the study combines shared requirements for employability, intercultural competence, and international engineering education with tasks specific to the transportation industry. Its principal contributions are to translate an international perspective from a general aspiration into concrete outcome dimensions, transform academic advising from transactional information provision into capability-development support throughout the educational process, and incorporate student work, project performance, and multi-stakeholder feedback into evidence for quality improvement.

II. Logical Alignment between OBE and an International Employability Orientation

2.1 Dimensions of International Employability for Transportation-Related Programs

Transportation disciplines are systemic, open, and strongly practice-oriented. Students must understand transportation planning, transport operations, safety management, transport equipment, logistics, infrastructure, and other disciplinary domains. They must also be able to use data analytics, simulation, artificial intelligence, geographic information systems, and related tools to balance safety, efficiency, cost, environmental considerations, and the public interest. International work contexts further require students to understand technical standards, industry regulations, and organizational cultures across countries and regions; communicate technical judgments clearly in a professional foreign language; and assume responsibility in intercultural teams. Deardorff's research on intercultural competence indicates that openness, cultural knowledge, communication skills, and internal and external outcomes should be evaluated through multiple methods [9]. Jones argued that the transferable capabilities developed through international and intercultural experiences are strongly aligned with employer demand and that locally organized intercultural activities can also serve as effective learning environments [10].

Drawing on employability theory, common attributes of international engineering education, and the characteristics of the transportation industry, this study organizes international employability into six primary outcome dimensions. The framework integrates disciplinary capabilities and transferable capabilities while emphasizing complex engineering problem solving, communication and collaboration, ethical responsibility, and lifelong learning. The International Engineering Alliance's graduate attributes and professional competencies framework similarly identifies problem analysis, design, modern tools, social and environmental responsibility, teamwork, communication, project management, and lifelong learning as key outcomes for engineering professionals [11].

International employability is both contextual and developmental. Its contextual nature means that the same capability may be expressed differently across positions, countries and regions, modes of transportation, and organizational types. Aviation, port and shipping logistics, rail transit, and road planning, for example, differ in regulatory systems, risk levels, and stakeholder structures; no fixed skills checklist can cover all areas. Its developmental nature means that students do not acquire employability at a single point before graduation. Instead, they develop it progressively through disciplinary orientation, foundational training, integrated practice, and career transition. The six outcome dimensions in Table 1 therefore constitute a common baseline while allowing schools to establish specialization-specific indicators in accordance with their institutional positioning and enabling students to form differentiated combinations of outcomes aligned with their career goals.

Table 1: International Employability Outcome Framework for Transportation-Related Programs.

Outcome Dimension	Key Competencies	Observable Evidence of Outcomes
International Professional and Engineering Practice	Apply transportation knowledge to analyze complex systems; understand international engineering standards, industry regulations, and regional differences	International case analysis, alternative comparison, standards crosswalk, simulation or planning report
Digital Intelligence and Innovation	Use data analytics, GIS, simulation, and artificial intelligence tools; recognize technological boundaries and develop innovative solutions	Data products, models or code, visualization dashboards, innovation-project outputs
International Communication	Use a professional foreign language for information retrieval, writing, presentations, and negotiation; explain technical solutions to different stakeholders	Bilingual abstracts, technical reports, English presentations, mock defense or negotiation records

Intercultural Collaboration and Project Management	Respect cultural differences; collaborate in diverse teams, manage conflict, and control schedule and risk	Team projects, role logs, peer assessment, project plans, and post-project reviews
Sustainable Development and Professional Ethics	Integrate safety, low-carbon development, accessibility, equity, legal compliance, and the public interest	Safety and carbon-impact assessments, ethical case analysis, compliance checklists
Career Adaptability and Lifelong Learning	Develop career identity, access global career information, self-assess, learn proactively, and navigate career transitions	Competency profiles, electronic portfolios, certificates or micro-courses, personal development plans

2.2 Backward Design with International Employability as the Endpoint

The six outcome dimensions should be further decomposed into observable performance standards and mapped to academic advising activities and assessment tasks. The backward-design sequence is as follows. First, the international employability expected at graduation is determined through industry research, alumni feedback, international accreditation requirements, and the positioning of the talent-development program. Second, staged milestones are established according to students' year of study and prior preparation. Third, course consultation, project-based practice, mentoring, international exchange, and career services are configured to support those milestones. Finally, direct outcome evidence is collected to determine attainment and revise the advising plan. Through this approach, foreign-language learning, international exchange, disciplinary competitions, and internships are no longer isolated activities but multiple learning opportunities serving specified capability outcomes.

The OECD Learning Compass 2030 emphasizes student agency and the integrated development of knowledge, skills, attitudes, and values [12]. The World Economic Forum's Future of Jobs Report 2025 identifies analytical thinking, resilience and flexibility, leadership and social influence, creative thinking, technological literacy, lifelong learning, systems thinking, and environmental stewardship as important capabilities in the future labor market [13]. Academic advising oriented toward international employability must therefore prepare students to enter globalized work environments while also strengthening their long-term capacity to respond to technological change, the green transition, and occupational mobility.

The role of OBE in this system is not to mechanize and quantify every developmental process but to establish clear alignment. Outcome statements should use observable action verbs; advising activities should provide repeated opportunities for practice and feedback; and assessment tasks should authentically demonstrate levels of capability. For example, 'understanding intercultural communication' is difficult to assess directly and can instead be reformulated as 'being able to explain technical disagreements, coordinate roles, and develop a shared solution in an intercultural team.' Corresponding activities should include team projects, scenario-based conflicts, and reflective review rather than knowledge transmission alone. Attainment data can meaningfully support improvement only when goals, learning opportunities, and outcome evidence are aligned; such alignment also prevents OBE from being reduced to form completion.

III. Current Challenges in Aligning Academic Advising with International Employability

The current difficulties do not simply arise from the absence of several activities. More fundamentally, systematic connections are lacking among educational objectives, advising content, practice resources, and evaluation mechanisms. On the one hand, program curricula already emphasize international perspectives, engineering practice, and lifelong learning, whereas academic advising remains centered on isolated administrative milestones. On the other hand, although institutions have some foundations in international cooperation, corporate internships, innovation competitions, and foreign-language learning, these activities have not been integrated through a shared outcome framework. This produces a structural contradiction: many activities but an unclear capability pathway, and substantial participation but insufficient outcome evidence. The problem is manifested in the following four areas.

3.1 Advising Objectives Remain at the Level of an 'International Perspective' and Lack Assessable Outcome Statements

Some academic advising practices interpret internationalization primarily as policy context, introductions to overseas institutions, or improvement in foreign-language scores. Their objectives are often expressed as 'broadening international perspectives' or 'enhancing overall quality' without specifying the tasks students should perform in particular transportation contexts or the standards they should meet. Ambiguous objectives lead disciplinary faculty, academic advisors, and international exchange staff to conduct separate activities while making it difficult to determine whether those activities jointly advance international employability. They also prevent students from developing clear personal pathways.

3.2 Fragmented Advising Content and Weak Alignment with International Occupational Tasks and Disciplinary Learning

Existing advising content commonly focuses on explaining curricula, selecting courses, preparing for postgraduate entrance examinations, and developing job-search skills. Professional foreign language, intercultural communication, international standards, digital tools, green transportation, project management, and professional ethics are often dispersed across different courses or activities. Even when students participate in several activities, they may be unable to transfer their knowledge to scheme design, data analysis, risk communication, and team decision making in international transportation projects. If academic advising provides only a checklist of information, it cannot serve as the hub connecting the curriculum, occupational tasks, and individual capability development.

3.3 Insufficient Authentic Internationalized Practice and Weak Multi-Stakeholder Collaboration

Classroom lectures and one-way experience sharing rarely generate observable capability performance in complex tasks. Some students cannot participate in overseas exchanges because of language, financial, or opportunity constraints. Meanwhile, international students on campus, intercultural courses, authentic problems from international enterprises, and globally available open data have not been fully converted into internationalization-at-home learning environments. Stable collaboration is also lacking among schools, career services, international cooperation offices, enterprises, and alumni, causing academic advising to become disconnected from corporate capability needs, international project processes, and individual student differences.

3.4 Evaluation Overemphasizes Participation and Satisfaction and Lacks Outcome Evidence and an Improvement Loop

Academic advising is commonly evaluated through attendance, the number of activities, questionnaire satisfaction, or post-graduation destinations. These indicators can reflect inputs or results, but they do not directly show whether students possess intercultural communication, complex problem-solving, and career adaptability. A survey of German enterprises in China by Zhu et al. found that graduates of Chinese universities received relatively positive assessments for disciplinary knowledge and skills, but clear gaps remained between employer expectations and graduates' social capabilities and personal qualities [14]. Shi and Ren likewise showed that university students' employability comprises disciplinary knowledge and skills, generic capabilities, and personality traits, with the formal curriculum, extracurricular learning, and internships playing different roles [15]. A single summative indicator cannot provide sufficient evidence for improving advising content.

IV. Optimization and Development of an International-Employability-Oriented Academic Advising System

4.1 Establishing a Three-Level Goal System of Graduate Outcomes, Staged Indicators, and Personal Goals

Using the six outcome dimensions in Table 1 as a foundation, each school should develop graduate-level international employability standards that reflect its transportation specializations, industries served, and students' intended destinations. It should then decompose these standards into staged indicators at four levels: awareness, application, integration, and transfer. International communication, for example, may progress from reading English technical materials, to preparing a bilingual technical abstract, presenting a proposal in an intercultural team, and negotiating with different stakeholders. After enrollment, students should form personal competency profiles through capability self-assessment, interest assessment, prior learning experiences, and career intentions. With mentor support, they can then select priority outcomes and evidence of development, avoiding the replacement of personalized advising with a uniform template.

Personal goals should be differentiated above the common outcome baseline. Students intending to join international engineering projects or multinational enterprises may emphasize professional foreign language, international rules, project negotiation, and intercultural teamwork. Those preparing for international cooperation activities within China's transportation sector may focus on standards comparison, cross-border supply chains, and multi-stakeholder communication. Students without a defined direction can broaden their occupational awareness through rotational experiences and short-cycle tasks. Mentors should organize at least one goal review each academic year and record new experiences, evidence of capability, and changes in career intention in the development plan. Personal goals can thus remain continuous while adapting to learning performance and changes in the industry.

4.2 Developing a Staged Advising Content Pathway throughout the Educational Process

The first stage should focus on disciplinary orientation and career awareness. Global transportation-system cases, maps of disciplinary specializations, international occupational clusters, and alumni experiences can help students understand the relationship between disciplinary learning and international occupational tasks

and complete an initial competency profile and learning plan. The second stage should establish foundational capabilities by embedding professional foreign language, information retrieval, data literacy, intercultural communication, academic integrity, and introductions to international standards in course-selection and learning-strategy advising. The third stage should emphasize integrated practice by organizing project-based learning around intelligent transportation, green logistics, transportation safety, urban public transport, or cross-border transportation, enabling students to produce verifiable work. The fourth stage should support career transition through international position analysis, capability-gap diagnosis, bilingual resumes and interviews, professional qualifications, and consultation on regional regulations, guiding students to complete an electronic portfolio and a post-graduation lifelong-learning plan.

Staged content should not become an add-on checklist outside the curriculum; it should enter authentic learning through curriculum embedding, project continuity, and ongoing advising. Schools can establish an outcome-course-activity map showing where each outcome is introduced, reinforced, and integrated. Academic advisors can use the map to help students select courses and practice opportunities rather than recommending isolated activities. Each stage should include at least one integrative task, such as comparing urban transportation governance schemes across countries, using open data to conduct transportation-demand analysis, or developing a risk- and carbon-reduction plan for a cross-border logistics scenario. Tasks should simultaneously mobilize disciplinary knowledge, digital tools, communication and collaboration, and ethical judgment, enabling students to create complete portfolio-ready work.

4.3 Building an 'Internal Collaboration - Industry Participation - Internationalization at Home' Practice Platform

Schools can establish academic advising coordination groups involving program leaders, academic mentors, student advisors, foreign-language teachers, international cooperation staff, career-development staff, enterprise mentors, and alumni. Disciplinary faculty can translate international standards and complex engineering problems into tasks; language and intercultural faculty can support professional communication; career services can provide occupational data and career tools; and enterprise mentors can evaluate the feasibility of proposed solutions. Students unable to travel abroad can engage in accessible and sustainable internationalization-at-home settings through mixed teams with international students, global open data, inter-institutional online collaboration, remote reviews of overseas engineering cases, and local projects operated by multinational enterprises. Overseas exchanges should include pre-assessment, task lists, process reflection, and outcome presentations rather than being limited to records of experience.

4.4 Implementing a Multi-Stakeholder, Process-Wide, Evidence-Based Evaluation Mechanism

Evaluation should include diagnostic, formative, and summative stages. At enrollment and the beginning of each academic year, self-assessment, mentor interviews, and foundational tasks can identify gaps. During projects, analytic rubrics can evaluate disciplinary accuracy, tool use, communication and collaboration, ethical judgment, and the quality of reflection. At graduation, teachers, enterprise mentors, peers, and students themselves should jointly review portfolios. Direct evidence may include technical reports, data products, bilingual presentations, team projects, and internship evaluations; indirect evidence may include questionnaires, interviews, graduate destinations, and employer feedback. Evidence from different sources should be triangulated, avoiding the use of foreign-language scores, award counts, or employment rates as substitutes for international employability.

At the operational level, four-level rubrics can be established for each of the six outcome dimensions, using performance descriptors and representative evidence rather than broad scores alone. For intercultural collaboration, for example, the foundational level may involve completing assigned work and respecting differences; the application level may require clearly expressing views and responding to feedback; the integration level may involve coordinating conflict and synthesizing different opinions; and the transfer level may require advancing joint decisions within unfamiliar teams and under new constraints. Attainment analysis should examine both the overall proportion of students meeting expectations and differences across specializations, prior experiences, and student groups. When direct evidence conflicts with student self-assessment, the authenticity of the task and consistency of scoring should be reviewed first. Sample moderation, assessor training, and rubric calibration can then improve evaluation reliability.

4.5 Establishing an Outcome-Attainment-Based Continuous Improvement and Assurance Mechanism

Schools should establish an annual cycle of outcome setting, activity implementation, evidence collection, attainment analysis, and plan improvement, while reviewing the outcome framework every two or three years in response to industry change. If an outcome remains below the target, the school should determine whether the target is excessively demanding, learning opportunities are insufficient, assessment tasks are inauthentic, or resources are poorly allocated before revising advising content, expanding practice settings, or

providing faculty development. A unified digital portfolio platform should record student outcomes rather than activity counts alone. Schools should also improve mentor training and workload recognition and provide differentiated tasks and resources for students with different language foundations, economic circumstances, and international experience, ensuring that international employability development is accessible rather than an additional opportunity reserved for a minority.

Three types of risk should also be addressed. First, where departmental responsibilities overlap but accountability is unclear, the school should designate outcome owners, data custodians, and improvement deadlines. Second, digital platforms may overemphasize recording and underuse analysis; schools should follow the data-minimization principle, protect student privacy, and use data for feedback rather than simplistic ranking. Third, enterprise participation may remain at the level of occasional lectures; stable collaboration should instead be developed through jointly designed tasks, co-evaluation of student work, and feedback to courses. Student representatives can be included in annual reviews, and teacher observations, enterprise opinions, and student workload can be considered together when judging feasibility. The ultimate criterion for continuous improvement is not an increase in the number of activities, but whether students receive high-quality learning opportunities, produce credible outcomes, and can clearly explain how those outcomes support their international career development.

V. Conclusion

Optimizing academic advising for transportation-related programs around international employability does not primarily require adding more international lectures or directing students toward a single overseas destination. The key is to use OBE principles to clarify the outcomes that students should be able to demonstrate in globalized occupational contexts and to align advising objectives, content, practice, evaluation, and improvement. The six-dimensional outcome framework translates an abstract international perspective into concrete professional actions and evidence. The staged content pathway and collaborative practice platform expand opportunities for capability development, while multi-stakeholder evaluation and continuous improvement ensure that the system evolves in response to student development and industry needs. Future empirical studies should examine different types of institutions and transportation specializations, test the relative weights of outcome indicators and the reliability and validity of their evaluation, and investigate their long-term effects on graduates' international career adaptation and sustainable development.

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