ISSN NO: 2770-4491
September 2026

Developing Communication Skills Of Future Road Engineers Through Digital Learning Platforms: A Methodological Framework

Alijon Olimjonovich Muxammadjonov
Tashkent Kimyo International University, Namangan Branch, Uzbekistan
ORCID: 0009-0000-9279-6138
E-mail: alijon19920929@gmail.com

Abstract: The preparation of future road engineers requires not only strong technical knowledge but also the ability to communicate technical information clearly, collaborate with multidisciplinary teams, document engineering decisions, and interact professionally with stakeholders. This article examines a methodological framework for developing these communication skills through digital learning platforms. The proposed framework combines learning management systems, collaborative digital workspaces, mobile applications, discussion forums, electronic portfolios, and rubric-based feedback with authentic road-engineering tasks. The methodology is organised around diagnostic assessment, structured digital practice, formative feedback, reflection, and outcome evaluation. The article draws on the author's research context, in which the dissertation abstract reports an experimental group of 201 participants and a control group of 199 participants, with the communication-skill outcome in the experimental group reported as 1.132 times that of the control group (a 13.2% relative advantage). However, the abstract does not provide the raw pre-test and post-test scores, dispersion measures, or statistical test results; therefore, these figures are presented as reported contextual evidence rather than as a fully reproducible statistical analysis. The article offers an implementation model, assessment indicators, sample activity matrix, and recommendations for integrating digital platforms into road-engineering education.
Keywords: digital learning platforms; communication skills; future road engineers; engineering education; collaborative learning; formative assessment; digital pedagogy; road engineering.

INTRODUCTION. Road engineering is a professional field in which technical decisions must be communicated accurately to colleagues, public authorities, contractors, road users, and communities. A graduate may be expected to explain a pavement defect, present a traffic-safety proposal, prepare a technical report, coordinate a site team, or respond to a stakeholder's concerns. These activities require a combination of technical vocabulary, oral presentation, professional writing, listening, negotiation, teamwork, and digital collaboration. Communication is therefore not an optional supplement to engineering knowledge; it is part of competent engineering practice. At the same time, digital technologies have changed how engineering students access information, coordinate projects, submit technical work, and receive feedback. Learning management systems (LMSs), online discussion boards, shared documents, video conferencing, mobile field-data tools, digital portfolios, and simulation environments can create repeated opportunities to practise professional communication. Their educational value, however, depends on instructional design. Simply transferring lecture notes to an online platform does not guarantee communication development. Tasks must require students to explain, question, negotiate, document, and revise technical ideas. For future road engineers, digital learning activities can be connected directly to authentic professional situations: describing road-surface defects from field photographs, preparing a concise inspection report, presenting alternative junction designs, discussing traffic-management options, or coordinating a team response to a simulated road-safety problem. These tasks allow technical learning and communication practice to reinforce one another. The purpose of this article is to present a practical methodological framework for developing future road engineers' communication skills through digital learning platforms. The article addresses four questions: (1) which communication competencies should be targeted; (2) how can digital platforms structure repeated, authentic communication practice; (3) how can progress be assessed transparently; and (4) what implementation conditions are needed for a sustainable approach?

ISSN NO: 2770-4491
September 2026

The article contributes an integrated framework that links digital tools, road-engineering tasks, communication competencies, and assessment evidence. It also translates the reported experimental context in the author's dissertation abstract into cautious practical interpretation without inventing unreported raw scores.

LITERATURE REVIEW AND CONCEPTUAL BACKGROUND. Research in engineering education commonly treats communication as a combination of oral, written, interpersonal, and visual or digital practices. Engineers must explain technical evidence to both specialist and non-specialist audiences, collaborate across professional roles, and preserve decisions in reports and records. This means that communication instruction is most meaningful when embedded in disciplinary tasks rather than taught only as a detached language or presentation exercise.

Digital learning platforms can support this integration in several ways. First, asynchronous discussion spaces give students time to formulate arguments and respond to peers. Second, shared documents and project boards make contributions visible and support collaborative drafting. Third, audio and video submissions allow students to rehearse technical explanations and review their own performance. Fourth, e-portfolios preserve evidence of progress over time. Finally, rubrics and analytics can make feedback more specific and help instructors identify students who need additional support. A key design principle is alignment: each digital activity should have a clearly defined communication outcome, a realistic engineering context, and an assessment criterion. For example, if the target is technical explanation, a student might upload a short video explaining the causes and implications of a road defect using a photograph and a technical glossary. If the target is teamwork, a group might co-author a traffic-management proposal, record individual responsibilities, and complete a peer-assessment form. The methodological approach in this article is therefore informed by three complementary ideas: authentic task-based learning, collaborative learning, and formative assessment. Authentic tasks give communication a professional purpose; collaborative learning creates a need to negotiate meaning and coordinate contributions; formative assessment provides feedback that can be applied to a revised performance. The effectiveness of these principles depends on accessibility, instructor preparation, reliable assessment criteria, and opportunities for students to practise more than once.

RESEARCH DESIGN. This article uses a design-oriented methodological approach. It synthesises the author's stated research focus—developing communication skills of future road-engineering graduates through digital technologies—and translates it into an implementation framework suitable for higher education. The framework specifies target competencies, platform functions, learning activities, assessment evidence, and a continuous feedback cycle. The dissertation abstract available for the present article reports an experimental group of 201 participants and a control group of 199 participants. It also reports that the communication-skill outcome in the experimental group was 1.132 times higher than in the control group, described as a 13.2% relative advantage. Because the available abstract does not include raw scores, baseline equivalence data, standard deviations, confidence intervals, or the statistical test used, the current article does not recalculate statistical significance or claim causal certainty beyond what the abstract reports.

The proposed methodology operationalises communication skills through five observable dimensions. These dimensions are intended to be adapted to the course syllabus and the institution's assessment regulations.

Competency dimension	Observable performance	Example evidence
Technical oral communication	Explains a road-engineering problem logically, uses terminology accurately, and answers questions.	Recorded explanation; live presentation; oral defence.
Professional writing	Produces clear, structured and evidence-based technical reports, emails and recommendations.	Inspection report; project memo; professional email.
Collaborative communication	Shares responsibilities, listens actively, responds constructively and resolves task-related disagreement.	Group discussion log; shared project document; peer review.

ISSN NO: 2770-4491
September 2026

Digital communication	Uses appropriate platforms and formats, communicates respectfully online, and documents decisions.	Forum contribution; version history; online meeting notes.
Audience awareness and feedback literacy	Adjusts explanations for technical/non-technical audiences and uses feedback to improve work.	Two versions of a briefing; revised report; reflection.

Digital learning environment. The framework does not depend on a single commercial platform. Institutions can implement it through an existing LMS and commonly available digital tools, provided that data protection and institutional policies are respected. The essential functions are presented below.

Digital function	Pedagogical use	Road-engineering example
LMS course space	Distribute materials, sequence tasks, collect submissions and maintain progress records.	Upload road-safety case materials and a technical-report template.
Discussion forum or chat	Practise written argument, questioning and professional etiquette.	Discuss competing options for a junction redesign.
Shared document/project board	Coordinate tasks, co-author technical work and track decisions.	Prepare a group road-inspection report with assigned roles.
Mobile field-data or photo tool	Connect observation to accurate description and evidence-based communication.	Annotate a road defect photograph and write a concise description.
Video/audio submission	Practise oral explanation and presentation; allow self-review.	Record a two-minute briefing on a proposed traffic-management measure.
E-portfolio and rubric	Collect evidence over time and support transparent assessment.	Compare an initial report with a revised version after feedback.

The framework is organised into five connected stages. The instructor begins by diagnosing students' current performance, then provides authentic digital tasks, supports structured collaboration, gives specific formative feedback, and evaluates revised performance. The stages should be repeated rather than treated as a one-off sequence.

Stage	Instructor action	Student action	Evidence collected
1. Diagnose	Administer a short technical explanation and writing task; explain the rubric.	Complete an initial report or oral explanation.	Baseline rubric scores and learner reflection.
2. Model and prepare	Provide examples, technical vocabulary support, and task criteria.	Analyse a model report/video and identify quality features.	Short quiz, checklist or annotated model.
3. Practise digitally	Assign individual and group tasks in the	Discuss, draft, present, question and document decisions.	Forum posts, shared-document history, recordings.

ISSN NO: 2770-4491
September 2026

	LMS/shared workspace.		
4. Feedback and revision	Give criterion-based feedback and facilitate peer review.	Revise work and explain which feedback was used.	Draft/final comparison and reflection.
5. Evaluate and reflect	Score final performance using the same rubric; compare evidence over time.	Submit a portfolio and set next-step goals.	Post-task scores, portfolio and self-assessment.

A common rubric can improve consistency across instructors and make progress visible to students. The following five-level scale is proposed for local adaptation: 1 = beginning; 2 = developing; 3 = competent; 4 = proficient; 5 = advanced. The rubric should be shared before the task and applied to both initial and revised work.

Criterion	**What is assessed**	**Suggested weight**
Accuracy and use of technical language	Correct use of road-engineering concepts, terms and evidence.	25%
Clarity and structure	Logical sequence, concise wording, signposting and understandable conclusions.	20%
Audience and purpose	Appropriate detail and tone for the intended professional or public audience.	15%
Interaction and teamwork	Listening, relevant responses, respectful disagreement and contribution to shared work.	20%
Digital professionalism and revision	Appropriate tool use, documentation, source attribution and application of feedback.	20%
Total		100%

For quantitative evaluation, instructors can report the mean rubric score before and after the intervention, the change in score, the distribution of achievement levels, and—where data and assumptions permit—an appropriate statistical comparison. If experimental and control groups are used, baseline comparability, sample attrition, assessment reliability, effect sizes, and uncertainty intervals should be reported. A relative percentage alone is not sufficient to establish statistical significance.

RESULTS. The principal output of the methodological design is an integrated cycle connecting digital platform functions with professional communication practice. Figure 1 summarises how digital learning tools, authentic activities, communication practice, and feedback can work together to develop competencies relevant to road engineering.

ISSN NO: 2770-4491
September 2026

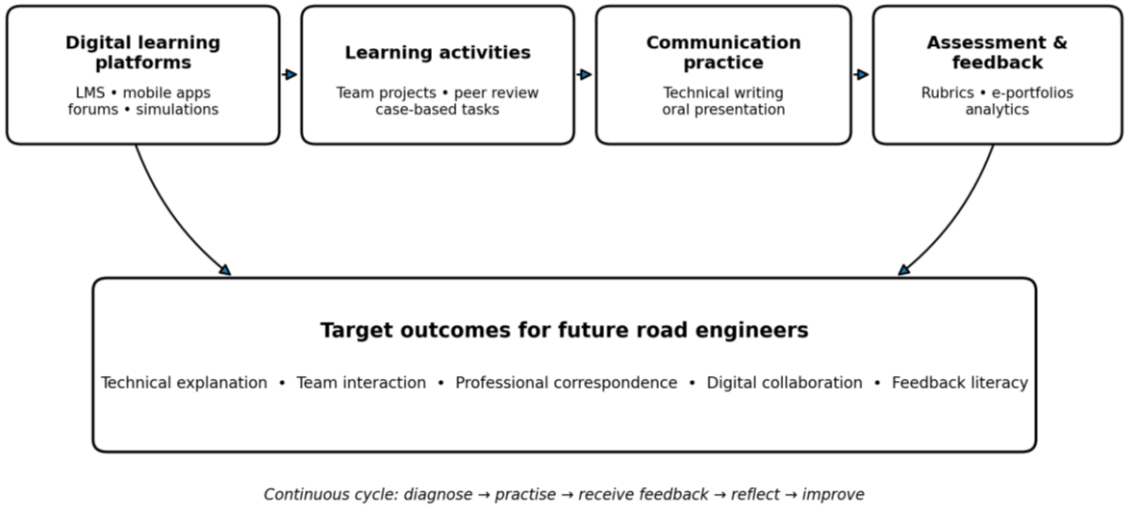


Figure 1. *Proposed framework for developing communication skills through digital learning platforms.*

The framework indicates that the platform itself is not the learning outcome. Its role is to make practice, collaboration, feedback, and revision possible and traceable. Communication develops when students repeatedly perform meaningful professional tasks and receive actionable feedback.

The dissertation abstract associated with the author's research reports 201 participants in the experimental group and 199 in the control group. It states that the communication-skill outcome for the experimental group was 1.132 times the control-group outcome, equivalent to a reported relative advantage of 13.2%. Figure 2 displays these reported figures. The sample counts and reported relative advantage are reproduced as supplied; the figure does not imply that raw scores or statistical significance have been independently verified.

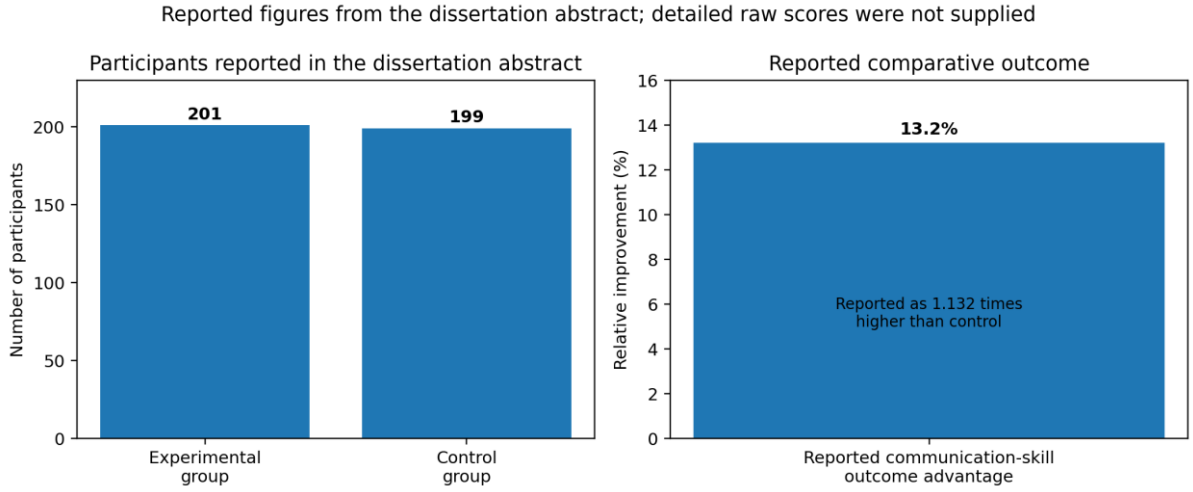


Figure 2. Sample sizes and reported comparative outcome from the dissertation abstract.

Indicator	Reported value	Interpretation and limitation
Experimental group	201 participants	Group size reported in the dissertation abstract.
Control group	199 participants	Group size reported in the dissertation abstract.
Comparative communication-skill outcome	1.132 times the control-group outcome	Reported comparative result; underlying scale and calculation are not shown in the available abstract.
Relative advantage	13.2%	Equivalent to the reported 1.132 ratio when expressed as a relative increase; should not be confused

ISSN NO: 2770-4491
September 2026

		with a 13.2 percentage-point increase.
Raw pre-test/post-test scores	Not provided in the available abstract	Cannot independently calculate gain scores, effect size, confidence intervals, or statistical significance.

To make the framework actionable, Table 5 proposes a sequence of digital activities that can be incorporated into courses in road engineering, traffic management, road construction, and transport infrastructure. The activities are examples of implementation, not claims that each activity was independently tested in the reported experiment.

Task	Platform-mediated activity	Communication product	Assessment focus
Road-defect case	Students annotate a field photograph and discuss likely causes in a forum.	Defect description and short technical recommendation.	Accuracy, clarity, evidence use.
Traffic-safety proposal	Teams compare alternatives in a shared workspace and document a decision.	Two-minute video pitch plus a one-page memo.	Argument quality, audience awareness.
Site-team coordination	Students role-play engineer, contractor and local authority in an online meeting.	Meeting minutes and action register.	Listening, turn-taking, negotiation.
Public-facing explanation	Students rewrite a technical finding for a community audience.	Plain-language notice or infographic script.	Accessibility, tone, concise explanation.
Peer review and revision	Students review a peer's report using the shared rubric, then revise their own.	Annotated draft, final report and reflection.	Feedback literacy, revision quality.

A course team can use a simple dashboard to monitor participation and learning evidence. The measures below are recommended indicators; no numerical values are assigned because platform analytics and student scores were not supplied for this article.

Indicator	How to calculate or observe it	Review frequency	Decision supported
Task completion	Completed submissions ÷ expected submissions × 100.	Weekly	Identify students who need support.
Quality of technical writing	Mean rubric score for clarity, structure and terminology.	Each major task	Target writing workshops.
Quality of interaction	Rubric score for relevance, respectful response and contribution.	Every group task	Improve discussion prompts and group roles.
Revision uptake	Number of applicable feedback points addressed in the final version.	Each revised task	Strengthen formative feedback.
Portfolio progression	Change between initial and later rubric-scored artefacts.	Midpoint and end of course	Evaluate development across the course.

ISSN NO: 2770-4491
September 2026

The practical value of this dashboard lies in using evidence to adjust teaching. For example, frequent task completion with weak technical explanations may indicate that students need models and vocabulary support; strong individual reports but weak group outcomes may indicate that roles and collaboration protocols need to be clarified.

DISCUSSION. The proposed framework treats communication as a professional capability developed through repeated engineering work. This is particularly relevant to road engineering because communication products—inspection reports, safety recommendations, design presentations, meeting minutes, and public explanations—are closely connected to technical decisions. Digital platforms can make these products visible, editable, and assessable across the learning process. A key advantage is the integration of individual accountability and collaboration. Students can be assessed on their own report or presentation while also contributing to a shared technical product. Version histories, peer comments, discussion posts, and reflections can provide evidence of the process as well as the final result. This reduces the risk of judging communication solely from one end-of-course presentation. The reported 13.2% relative advantage in the dissertation abstract is consistent with the practical expectation that a structured digital intervention may support communication-skill development. Nevertheless, the result should be interpreted cautiously. Without the underlying scores, scale definition, pre-test comparability, statistical tests, and implementation details, the magnitude and robustness of the reported difference cannot be independently assessed from the abstract alone. A future publication should report the full evaluation protocol and quantitative results transparently.

Implementation also presents challenges. Students may have unequal access to devices or reliable internet; digital participation may not accurately represent oral interaction; group work can conceal unequal contributions; and automated analytics may measure activity rather than learning quality. These risks can be addressed through low-bandwidth alternatives, offline task options, individual reflection, explicit group roles, transparent rubrics, and instructor review of actual communication artefacts. A further issue is academic integrity and responsible digital communication. Students should learn to attribute sources, protect personal and field data, avoid uploading sensitive site information without permission, and use AI-enabled writing tools transparently according to institutional policy. Digital fluency should be assessed alongside professional judgement, not treated as a substitute for it.

The framework can be adapted to different institutional contexts. A fully equipped digital campus may use integrated LMS analytics and e-portfolios, while a resource-constrained setting can begin with a course page, shared documents, mobile photographs, and structured feedback forms. The essential feature is not the sophistication of the software but the alignment between task, competency, feedback, and evidence.This article presents a methodological framework and interprets the limited quantitative figures reported in the dissertation abstract. It is not a substitute for a full empirical report. The available source does not provide the complete instrument, item-level data, pre-test and post-test means, standard deviations, reliability estimates, statistical test outputs, participant characteristics, or detailed intervention duration. Consequently, this article does not generate synthetic score tables or claim independent statistical verification. Future research should publish a detailed description of the digital intervention, the duration and frequency of activities, platform functions used, instructor training, and fidelity of implementation. It should also report the communication rubric and its reliability, baseline equivalence, missing-data handling, effect sizes with confidence intervals, and qualitative evidence from student reflections or interviews. A follow-up study could examine whether improvements transfer to workplace placements and professional communication tasks.

CONCLUSION. Digital learning platforms can support the development of future road engineers' communication skills when they are embedded in authentic, discipline-specific tasks and combined with collaboration, formative feedback, revision, and transparent assessment. The framework presented in this article links platform functions to five competencies: technical oral communication, professional writing, collaborative communication, digital communication, and audience awareness with feedback literacy. Its implementation sequence—diagnose, model, practise, give feedback, revise, and evaluate—provides a practical structure for courses in road engineering and transport infrastructure. The author's dissertation abstract reports an experimental group of 201 participants, a control group of 199 participants, and a communication-skill outcome reported as 1.132 times higher in the experimental group, or a 13.2% relative advantage. These figures provide contextual support for further investigation, but the absence of raw scores

ISSN NO: 2770-4491
September 2026

and statistical details means that the result should not be overinterpreted. For stronger evidence, future studies should report complete quantitative analyses and transparent measurement procedures. For higher education institutions, the main recommendation is to assess communication through repeated professional artefacts rather than relying on a single final presentation. Technical reports, field observations, collaborative proposals, recorded briefings, peer feedback, and e-portfolios can create a coherent evidence base for students' progress and help align university learning with the communication demands of road-engineering practice.

REFERENCES

1. Muxammadjonov, A. O. (n.d.). Bo‘lajak yo‘l muhandisligi yo‘nalishi bitiruvchilarini kommunikativ ko‘nikmalarini raqamli texnologiyalar asosida rivojlantirish metodikasi [Dissertation abstract, specialty 13.00.02]. Full bibliographic details should be completed from the official copy.
2. UNESCO. (2023). Global Education Monitoring Report 2023: Technology in education: A tool on whose terms? UNESCO.
3. OECD. (2019). OECD Future of Education and Skills 2030: OECD Learning Compass 2030. OECD.
4. ABET. (2024). Criteria for Accrediting Engineering Programs, 2024–2025. ABET.
5. International Engineering Alliance. (2021). Graduate Attributes and Professional Competencies. International Engineering Alliance.
6. Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. Studies in Higher Education, 31(2), 199–218. https://doi.org/10.1080/03075070600572090
7. Prince, M. (2004). Does active learning work? A review of the research. Journal of Engineering Education, 93(3), 223–231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.x
8. National Academies of Sciences, Engineering, and Medicine. (2018). How People Learn II: Learners, Contexts, and Cultures. The National Academies Press. https://doi.org/10.17226/24783