DEVELOPING PROFESSIONAL SPEAKING SKILLS OF ENVIRONMENTAL SCIENCE STUDENTS THROUGH DIGITAL TECHNOLOGIES

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Abstract. *The paper presents a methodology for developing the English professional speaking skills of environmental science students on the basis of digital educational technologies. The methodology rests on three design decisions: the unit of content selection is a professional spoken genre rather than a topic; digital tools are classified by the didactic function they perform (information-source, production-communication, monitoring-analysis) rather than by their technical type; and assessment is distributed across several sources within a six-criterion analytic rubric protected by a content-accuracy rule.*

Keywords: *English for Specific Purposes; professional speaking skills; genre analysis; digital linguodidactics; environmental science; asynchronous video response; analytic rubric; mediation; CEFR.*

1. INTRODUCTION

The widening of international cooperation in environmental protection requires environmental specialists to communicate at an international level. Climate change, transboundary water management, biodiversity conservation and waste utilisation are by their nature cross-border problems, and a specialist involved in solving them has to deliver a field briefing, present monitoring results, defend the conclusions of an environmental impact assessment, negotiate with regulatory authorities and take part in a public hearing — orally, under professional responsibility and, in most cases, in English.

Foreign language teaching in higher education, however, remains oriented mainly towards receptive activities — reading, terminology acquisition and translation — so that professional speaking is not developed systematically. In a conventional classroom the real speaking time available to an individual student is limited to a few minutes, and the interlocutors are peers of similar proficiency and background. Digital educational technologies can remove this structural constraint, yet in the literature they are studied predominantly as individual tools; a methodology integrating content, technology, stages of instruction and assessment into a single system — particularly for environmental science — has not been developed.

The aim of the study is to develop a methodology for developing the English professional speaking skills of environmental science students on the basis of digital educational technologies and to substantiate its effectiveness experimentally.

2. THEORETICAL BACKGROUND

The needs-analysis approach of English for Specific Purposes [1; 2] and the theory of genre as the property of a discourse community [3] justify treating a professional spoken genre, rather than a topic, as the smallest integral unit of content selection: mastering a genre is the acquisition not only of linguistic form but also of the norms of a professional community. The 4C framework of Content and Language Integrated Learning [4] was adapted to the field: because the content of environmental science is inherently contested, quantitative and publicly oriented, it provides a natural basis for speech activity at a high cognitive level — evaluating, justifying and negotiating.

The output hypothesis [5] and the theory of willingness to communicate [6] explain why an increase in the volume of individual speech production and a reduction of speaking anxiety are decisive conditions of skill formation. The Companion Volume of the Common European Framework of Reference [7] singles out mediation as an independent category; for an environmental specialist mediation is central rather than peripheral, since the professional value of the field lies in transferring scientific information into the spheres of policy, economics and the general public. The SAMR and TPACK models [8; 9] show that the methodological effect of technology depends on the level of its integration: use at the substitution level does not change the essence of the methodology, whereas real change occurs where the task itself becomes impossible to perform without the technology. The corpus-based selection of an academic lexical minimum [10] supplies the objective basis for the lexical component of content. The activity-based understanding of speech formation and the staged organisation of exercises rest on the classical works of the psycholinguistic and the national methodological schools [11; 12].

3. THE PROPOSED METHODOLOGY

The methodology is built on three design decisions. First, the unit of content selection is a professional spoken genre. Nine genres grouped by audience type were described — for colleagues (scientific presentation, field briefing, data report), for decision makers (defence of environmental impact assessment results, negotiation with a regulatory authority) and for the general public (risk communication, public hearing) — each with its compositional structure, leading language means, typical unexpected situations and required CEFR level. Genres are sequenced by the predictability of the audience and each recurs at least twice with increasing complexity.

Second, digital tools are classified not by technical type but by the didactic function they perform: information-source tools (authentic corpora, video archives, GIS and monitoring data), production-communication tools (asynchronous video-response platforms, artificial intelligence interlocutors, virtual exchange, simulation environments) and monitoring-analysis tools (criterion-referenced machine assessment, e-portfolio, peer review). This gives the teacher a decision rule and a criterion of structural completeness: a course relying on one group of tools only is methodologically incomplete. Thirteen digital linguodidactic methods were described within these groups and aligned with the nine genres by a matrix.

Third, the learning process is organised as a five-stage cycle repeated for every genre, with the largest share of time allocated to guided practice (Table 1). Its core method is the

asynchronous video response, which resolves the problem of insufficient individual speaking time. The role of artificial intelligence is deliberately limited to that of a practice interlocutor and is followed by an obligatory stage of performance before a human audience, with three mechanisms of academic integrity: separation of the practice and assessment stages, storage of process evidence in an e-portfolio, and documentation by the student of the way artificial intelligence was used.

Table 1

The five-stage learning cycle and the distribution of study time

Stage	Didactic purpose	Leading methods	Share of time
1. Orientation and diagnosis	Introducing the genre passport; baseline measurement	Diagnostic task set	10–12 %
2. Input and noticing	Discovering the norms of the genre	Genre analysis; corpus concordance; video model analysis	15–18 %
3. Guided practice	Repeated practice with decreasing scaffolding	Asynchronous video response; AI role-play; peer review	35–40 %
4. Independent professional performance	Performing the genre before a human audience	Simulation-negotiation; case and project work	20–22 %
5. Reflection and feedback	Multi-source assessment; self-regulation	Analytic rubric; reflective video diary; e-portfolio	10–12 %

Assessment is carried out with a six-criterion analytic rubric (professional content accuracy, genre competence, lexical and grammatical accuracy, intelligibility and fluency, interaction and mediation, multimodal presentation). Sources are distributed according to the nature of each criterion, and a protection rule applies: the lowest score on the first criterion excludes an overall high mark, because professionally incorrect content cannot count as successful professional speech however well it is expressed. All components are integrated by a five-block structural-procedural model (goal, methodological, content, technological-procedural and monitoring-result blocks) connected by vertical, horizontal, sequential and feedback links.

4. EXPERIMENTAL DESIGN

The experimental work was carried out at three higher education institutions with 244 students (124 experimental, 120 control) and 38 teachers, in three stages — ascertaining, formative and summative. Contact hours, the syllabus, the initial language level and the thematic coverage of materials were kept equal in both groups; the only difference was the methodology applied. Seven of the nine genres were covered within 98 hours. Competence was measured against three integral criteria — motivational-axiological, cognitive-

substantive and communicative-mediative — at three measurement points. Every final performance was video-recorded and rated by two independent experts, a third being involved whenever the discrepancy exceeded one point. The initial equivalence of the groups was confirmed statistically ($t = 0.12 < 1.97$).

5. RESULTS AND DISCUSSION

By the end of the experiment the share of students at the high level in the experimental group had risen from 10.5 % to 38.7 % and the share at the low level had fallen from 53.2 % to 12.1 %; in the control group the corresponding changes amounted to 5.8 and 15.0 percentage points, so that the gap between the groups at the high level reached 22.9 percentage points (Table 2).

Table 2

Distribution of professional speaking skill levels at the end of the experiment

Group	High level, %	Intermediate level, %	Low level, %	Mean score	V, %
Control (120)	15.8	45.0	39.2	2.03	69.7
Experimental (124)	38.7	49.2	12.1	3.03	43.8

Statistical analysis confirmed that the difference is not accidental: Student’s t-test gave $t = 5.69 > 1.97$ ($\alpha = 0.05$; $df = 242$) and Pearson’s chi-square test gave $\chi^2 = 29.44 > 5.99$ ($df = 2$); the confidence intervals of the two groups ([2.80; 3.27] and [1.78; 2.29]) do not overlap. The teaching efficiency index was $\eta = 1.49$ and the knowledge level index $g = 1.00$. The largest contribution to the chi-square value came from the low- and high-level cells, which indicates that the principal effect of the methodology consists in moving students out of the low level and into the high level.

Three findings deserve separate comment. First, the coefficient of variation in the experimental group was substantially lower (43.8 % against 69.7 %): the methodology not only raises the mean result but also reduces the spread within the group, that is, the gain is obtained by pulling up the weaker students rather than by advancing the stronger ones still further. Second, the analysis by genre revealed a regular pattern — the degree to which a genre is mastered is inversely proportional to its interactivity and unpredictability: the highest scores were recorded in monologic genres (field briefing — 4.02 points) and the lowest in the public hearing (3.12), which confirms the sequencing of genres by audience predictability. Third, growth was greatest on the motivational-axiological criterion (from 12.9 % to 41.9 %), which is consistent with the principle of a safe practice environment; on the other two criteria it amounted to 27.4 percentage points. The results were unidirectional across all three sites (a rise of 26.3–29.5 percentage points at the high level), which indicates that the effect depends on the methodology itself rather than on the conditions of a particular institution.

6. CONCLUSION

The study shows that digital educational technologies produce a methodological effect not in themselves but as part of an integral system in which genre-based content determines the method, the method determines the tool, the tool determines the stage, and the stage determines the source of assessment; the novelty of the solution lies in this systemic connection rather than in individual elements. Since the structural and procedural basis of the model is field-neutral, transfer to another specialism requires only the replacement of the content block — the system of genres, the lexical minimum and the case material. The limitations are stated openly: the experiment was conducted within a single specialism, its duration was limited to two semesters, skill retention was not tested separately, and a subjective component remains in the expert assessment of mediation.

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