TU Delft | OPEN Publishing

Research Article

Journal of Standardisation

Normung Insight 2.0: Instrument and Delivery Design in the First Pilot of a Value-Driven Blended Training Pathway at a National Standards Body

Teodora-Luiza Bulc [1,*]

[1]Austrian Standards International, Vienna, Austria

Abstract: National Standards Bodies (NSBs) acknowledge a responsibility for Education about Standardisation (EaS), yet instrument-level accounts of what they deliver remain rare. This paper reports the formative evaluation of the first pilot of Normung Insight 2.0, the redesigned introductory pathway of Austrian Standards International: a self-paced online module (N1) and two in-person modules on a single training day (N2, N3), aligned with the value-based Intended Learning Outcomes (ILOs) framework and the Innovative Teaching Concept of Standardisation (ITCoS) of EDU4Standards.eu. The design rationale, presented at EURAS 2026 without data, is confronted with first-cohort data (N = 7). Two anonymous instruments returned four online responses and six in-person submissions, so 85.7% is an upper bound on the in-person response rate; no baseline, knowledge test or observation of delivery was collected. Confidence ratings clustered at the top point, 25 of 36 for N2 and 26 of 36 for N3; the three lowest-rated N2 outcomes are the three whose practice elements the curriculum records as reduced or omitted; 23 of 24 value-cluster ratings were at the top point, so that item set did not discriminate; and three rating items without verbal anchors produced uninterpretable data. The pilot records post-training self-rated confidence, not a measured learning gain: its transferable yield is the instrument design itself. Five items are stated for the second pilot, planned for May 2027: one pedagogical hypothesis, one implementation lesson and three instrument corrections. An interim iteration, in which the serious game was replaced by a trainer-led session, bears on the implementation lesson.

* Corresponding author: t.bulc@austrian-standards.at

Submitted: 25-08-2026
Revised: 30-10-2026
Accepted: 05-11-2026
Published: 21-11-2026
Peer review: double blind

This work is licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence

DOI: https://doi.org/10.59490/jos.2026.9080

ISSN: 2772-9249

How to cite: Bulc, T.-L. (2026). Normung Insight 2.0: Instrument and Delivery Design in the First Pilot of a Value-Driven Blended Training Pathway at a National Standards Body. *Journal of Standardisation, 5*. https://doi.org/10.59490/jos.2026.9080

©2026 Authors. Published by TU Delft OPEN Publishing on behalf of the authors.

Keywords: Education about Standardisation (EaS), Value-Based Intended Learning Outcomes (ILOs), Innovative Teaching Concept of Standardisation (ITCoS), EDU4Standards.eu, Blended Learning, Formative Evaluation, Evaluation Instrument Design, National Standards Bodies (NSBs)

Highlights:

1. An item-level account of a value-based Intended Learning Outcomes design implemented by an NSB in professional training, from the first pilot of a three-module blended pathway.
2. The three outcomes of module N2 with the lowest confidence ratings are the three whose practice elements the curriculum records as reduced or omitted at the design stage.
3. Twenty-three of 24 value-cluster ratings sat at the top point, so that item set did not discriminate between participants.

4. Three rating items deployed without verbal anchors produced uninterpretable data in a national context with an entrenched grading convention.
5. Without a record of delivery, no confidence distribution can be related to what was delivered; five items are stated as hypotheses for the second pilot.

1 Introduction

Standardisation shapes markets, technologies, and societal outcomes, yet formal education on how standards are developed, negotiated, and applied remains uneven across European higher education and vocational training (Catalani Gabriel et al., 2022; European Commission, 2022). The EU Standardisation Strategy (European Commission, 2022) ties competitiveness to the standardisation skills that new areas such as artificial intelligence and cybersecurity require, and the measures it announces on education and skills are actions of the Commission itself: Standardisation University Days, initiatives for young researchers and networks under Horizon Europe and the Euratom Research and Training programme, and the dissemination of standardisation E-Learning material and of academic teaching modules through the EU Academy platform and the High-Level Forum. The obligation the Strategy places on the European standardisation organisations is a different one and concerns the content of standards: their special status carries responsibilities, and standards are to incorporate core EU democratic values and interests as well as green and social principles. The Horizon Europe project EDU4Standards.eu responds with a value-based Intended Learning Outcomes (ILOs) framework and an Innovative Teaching Concept of Standardisation (ITCoS), both structured to guide standardisation teaching across educational levels and in professional training (Mijatović, 2025; Veljanova, 2025).

Some evidence exists on how far that call has reached teaching practice. Surveying nine standardisation educators at European universities and interviewing twelve lecturers and practitioners across six countries, Mosakas et al. (2025, p. 6) found that most respondents address neither green and digital skills, nor gender issues, nor European interests, and that no single educator covered all the aspects the policy names. None of the interviewees was aware of any educational programme or course that directly adopts a value-based approach to education about standardisation (Mosakas et al., 2025, p. 7). The gap is specific: the Strategy promotes values in standardisation but does not carry that language into its section on education, so the policy that asks for value-based standardisation does not say what value-based education about it would consist of (Mosakas et al., 2025, p. 6, note 5).

For a National Standards Body (NSB), the strategic question is how to translate these frameworks into a workable training artefact. NSBs play a central role in stimulating Education about Standardisation (EaS), yet the ways in which they operationalise this mission remain heterogeneous and often under-documented (Catalani Gabriel et al., 2022, p. 5). Austrian Standards International, the recognised Austrian NSB and member of CEN, ISO and the European Telecommunications Standards Institute (ETSI), redesigned its long-standing introductory course Normung Insight into a value-driven, micro-modular pathway aligned with the value-based Intended Learning Outcomes framework and the ITCoS Knowledge Areas. The pathway addresses professionals who enter standardisation as committee experts: newly appointed delegates, staff of member organisations and users of standards without prior committee exposure. It is a professional training format and not a course for higher education, and the distinction bounds every claim in this paper. The redesign responded to course feedback collected between 2019 and 2025, which recorded three recurring issues: a format perceived as long and dense, with more than 300 slides and limited time for interaction; a balance skewed towards institutional and legal framing, with comparatively few exercises, cases, and guided

use of the electronic tools to be used when participating in standardisation, referred to below as the committee platform; and a heterogeneous audience addressed in a single linear format. Participants reported that they broadly understood how the system worked but did not feel sufficiently prepared to comment on draft standards, build coalitions or explain standardisation inside their own organisations (Bulc, 2026). That feedback is the ex-ante problem statement against which the present data are read. The design rationale was presented at the 30th EURAS Annual Standardisation Conference in Graz on 24 to 26 June 2026 (Bulc, 2026) as an ex-ante contribution: no empirical data on the redesign were available at that point.

The present paper reports the data returned by the first cohort. It is a formative first-pilot evaluation, not an effectiveness study. Reaction data and post-training self-rated confidence on the Intended Learning Outcomes were collected; learning was not measured, and behaviour was not observed. Section 2.5 sets out what each level of evidence in this paper can and cannot show. The research question is correspondingly narrow.

RQ. How was the first pilot of Normung Insight 2.0 received, and which implementation and instrumentation gaps became visible in the post-training data? The items derived from those gaps are stated as hypotheses for the second pilot and are not answers to the research question.

The primary contribution is a formative implementation and evaluation-design case; value-driven education about standardisation is the setting in which that case is made, not a claim the data support. The contribution is threefold. First, the paper reports two negative findings on the evaluation of such a pathway: a rating block deployed without verbal anchors that produced uninterpretable data in a national context with an entrenched grading convention, and the absence of any delivery record, which leaves every confidence distribution in the study unrelatable to what was delivered. Second, it offers an item-level account of a value-based Intended Learning Outcomes design implemented in a professional training setting led by an NSB, and reports within it the correspondence between the three lowest-rated operational outcomes and the practice elements the curriculum records as reduced or omitted at the design stage; no published evaluation of such a design, beyond the ex-ante description in Bulc (2026), is known to the author, and Mosakas et al. (2025, pp. 6 to 7) record that no interviewee was aware of one, a statement bounded by that survey and by its convenience sample. Catalani Gabriel et al. (2022, p. 5) likewise note that in-depth case descriptions of NSB education activities are hardly available. Third, it confronts the tentative ex-ante commitments from Bulc (2026) with the first-pilot signals and derives five items for the second pilot, stated as hypotheses rather than as validated recommendations.

Section 2 sets out the conceptual anchors and the intended learning architecture; Section 3 the delivered artefact, cohort, instruments, and method limitations; Section 4 the first-pilot data; Section 5 the ex-ante rationale confronted with those data and the items derived for the second pilot; and Section 6 the conclusions. Section 5.3.2 adds a first observation from an interim iteration, delivered on 14 October 2026.

2 Conceptual background

2.1 Policy context

The EU Standardisation Strategy (European Commission, 2022) positions standards as vehicles for European values (defined in Section 2.3) and for the green and digital transitions and treats the supply of standardisation skills as a policy concern, addressed through measures the Commission commits itself to carry out. Mosakas et al. (2025, p. 6) read the Strategy as naming the skills need without specifying the education that would meet it.

As requested by the EU Standardisation Strategy, the High-Level Forum on European Standardisation was set up in January 2023 as an expert group of the European Commission; its horizontal workstreams include education and skills (European Commission, n.d.).

At operational level, CEN and CENELEC have formalised their commitment through a CEN Workshop on guidelines for harmonised training on standardisation for higher education (CEN-CENELEC, 2025); the resulting CEN Workshop Agreement, CWA 18456:2026 Guideline for education and training on standards and standardisation, was published in October 2026 (CEN-CENELEC, 2026a). It addresses higher education, vocational and in-company training and trainers in NSBs alike (clauses 5.1 and 5.2) and makes the integration of European values and interests into standardisation education an explicit objective (clause 4.6).

At national level, the Austrian Standardisation Strategy 2024 (Bundesministerium für Arbeit und Wirtschaft, 2024) mirrors this priority and invites universities and universities of applied sciences to examine whether and how standardisation can be addressed in their courses; Mosakas et al. (2025, p. 11, note 11) read it as calling for education about standardisation without elaborating the tools or methods needed for it. The artefact reported here is one such tool, developed for professional training rather than for higher education. Drawing on responses from 90 NSBs worldwide, Catalani Gabriel et al. (2022) show that NSBs widely acknowledge the need for education about standardisation and typically undertake related activities, while the depth and form of these activities vary considerably and evidence on their effectiveness is largely absent; Blind and von Laer (2022) add that sustained participation is closely linked to a country's capacity to shape international technology trajectories, which depends on a workforce able to engage with standardisation processes.

2.2 Persistence of the gap and what it implies for design

Country studies in the edited volume of Idowu et al. (2020) document how far declared priority and observable practice diverge. Puiu (2020, pp. 103, 106) reports for Romania that most surveyed respondents had neither taught nor attended a course containing standardisation content and were not aware of the NSB; Vasileva (2020, pp. 85 to 92) reaches a structurally similar conclusion for Bulgaria, where provision remains unsystematic, fragmented, and dominated by management-system standards. Mijatović (2020, p. 192) adds an observation about the field itself: initiatives are numerous but largely isolated from one another, with many starting from scratch rather than building on documented prior work.

Two consequences follow for the design reported here. First, institutional and legal framing is not what draws an entry-level audience: Fomin (2020, pp. 31, 36, 42) reports that the conventional body of knowledge on standards is received as dry and abstract and that the usefulness of the concept has to be demonstrated before the concept itself is explained, and de Vries (2020a, p. 58) reports the same mechanism at the level of course titling. Second, an NSB cannot rely on a shared body of implementation evidence; it must generate its own and report it, including where the design underperformed. The project designing pilots across European higher education records the same obstacles at the outset: scarce teaching materials, a subject learners perceive as boring or overly technical, and hesitant teaching staff (del Álamo & Parada, 2025, p. 112).

2.3 The value-based Intended Learning Outcomes framework and ITCoS

EDU4Standards.eu operationalises the EU strategy through a value-based Intended Learning Outcomes (ILOs) framework (Veljanova, 2025). The framework rests on four pillars, distinguishes nine levels of qualification from early childhood to doctoral education, and comes in three parts: a general framework, a framework focused on European values, and a framework

integrating green, digital and gender skills (Veljanova, 2025, pp. 18, 23, 26). Its value layer takes the five core values of Article 2 of the Treaty on European Union, human dignity, freedom, democracy, equality and the rule of law, and groups further values around them (pp. 28, 29). In this paper, as in the framework, European values, or European core values where the course materials use that phrase, denotes this reference set of Article 2; where the course materials use EU values in a wider sense, as in the module N3 debrief (Section 3.1), the text says so. The adjective names its legal source and implies no claim that the values are exclusive to Europe. The Preamble to the Treaty describes freedom, democracy, equality, the rule of law and the inviolable and inalienable rights of the human person as universal values (Treaty on European Union, 2012, Preamble), the peer-reviewed account of the framework traces them to the principles of the 1948 Universal Declaration of Human Rights (Mosakas et al., 2025, p. 8), and the framework sets them alongside a similar set of intrinsic values in the constitutions of modern societies (Veljanova, 2025, p. 11). CWA 18456:2026 follows the same Treaty anchoring: it defines EU core values by Article 2, including respect for human rights and the rights of persons belonging to minorities (CEN-CENELEC, 2026a, clause 3.8), and treats them under the heading European values (clause 4.3). Mosakas et al. (2025, p. 10, Figure 1) set the framework out in the peer-reviewed literature: the five core values are a normative anchor rather than the whole value set, further values such as transparency, responsibility, autonomy and sustainability are context-dependent and derivative but are to be integrated into standardisation education alongside them, and Intended Learning Outcomes are the practical instrument for translating abstract policy values into teachable competences.

The framework is complemented by the Innovative Teaching Concept of Standardisation (ITCoS), which organises standardisation education into four Knowledge Areas and links these to teaching methods, materials, and pilot course designs (del Álamo & Parada, 2025, p. 30; Mijatović, 2025). The four are basic knowledge to raise awareness (KA1), standardisation interdependencies and roles in specific contexts (KA2), strategic use of standards (KA3) and strategic participation in standards development (KA4). Austrian Standards International has mapped its internal audience segmentation, N1 to N4, onto these Knowledge Areas; the mapping as delivered, and its widening during implementation, are reported in Table 1 and Section 5.1.

Mijatović (2020, p. 193) supplies the ordering principle applied here: learning outcomes define teaching methods, not the reverse. Where a curriculum is assembled from available content and fitted with outcomes afterwards, the outcomes describe coverage rather than capability. This is the mechanism by which a seminar of more than 300 slides (Bulc, 2026) can be reduced rather than merely shortened. The same chapter maps outcome levels onto methods: remembering and understanding are served by content followed by exploratory discussion, whereas practical application calls for learning by doing through serious games, role play or project involvement, with consensus in voluntary standardisation named explicitly as content for simulation and role play (Mijatović, 2020, pp. 202, 204). The framework side is matched by a demand side. Blind and Drechsler (2020, p. 113) describe participation in standardisation as a task that exceeds technical expertise, combining technical and business knowledge with soft skills such as consensus-oriented behaviour, negotiation, and communication, as well as knowledge of public policy and, in some cases, legal competence. An entry-level pathway cannot cover this range; it can decide deliberately which fields it opens and which it only signposts. The NSB states a comparable expectation in its own teaching material: committee participants are expected to hold expert knowledge, participate actively, prepare written contributions, comply with the rules of procedure and the code of conduct, and operate the tools provided for standards development (Austrian Standards International, 2026d; rules of procedure: Austrian Standards International, 2022, section 9).

2.4 Why strategic participation is worth teaching

The pathway must answer a central question for entry-level participants: why take part in standards development at all, when standards can also simply be applied. Three answers build on each other, and together they justify the pathway's focus on strategic participation.

The first answer is organisational. Standards are written by those who take part. An organisation that only applies them accepts requirements shaped by others; one that participates can align the standard with its go-to-market and intellectual property (IP) strategy before the standard becomes the reference for its market or, as a harmonised standard, a route to the presumption of conformity with legal requirements. At system level, the same link holds for a country's capacity to shape international technology trajectories (Section 2.1). For Austria, participation in international standardisation is a means of securing access to global markets and of ensuring that national and European interests are reflected in future technologies. The scale is visible in the committee base: at the end of 2025, 3,018 organisations nominated experts, 1,342 of them (44.5%) small and medium-sized enterprises (Austrian Standards International, 2026a, p. 16), and Austrian Standards had nominated 740 experts to 1,039 ISO technical bodies and 1,068 experts to 1,060 CEN technical bodies (Austrian Standards International, 2026a, pp. 18, 21). To be effective from the outset, these delegates and experts need to know the procedures and rules. In the terms of the value-based framework, the same point has a normative side. Openness and responsibility depend on who is present: an interest that no participant brings into a committee cannot enter its consensus.

The second answer is that participation has to be learned. It requires the competence profile set out in Section 2.3, which exceeds technical expertise, and it usually enters a professional's responsibilities early: more than one third of standardisation professionals report that it did so within the first year of employment and almost another third within the second to the fifth year (Blind & Drechsler, 2020, p. 129). Mosakas et al. (2025, p. 4) connect the new policy attention to skills with the impending retirement of the current generation of standardisation professionals, and the organisation states the same need publicly (Scoppetta, 2025), a declared institutional position reported here as such. In the Austrian system the barrier to a first act of participation appears to be one of competence. Drafts are open to comment free of charge by any person (Austrian Standards International, 2022, section 4.4.7), yet a comment that a committee can process requires knowledge of the procedure and, above all, of the principles and rules for the structure and drafting of standards, with which comments and proposed changes must comply (ISO/IEC, 2021).

The third answer concerns strategy. Heß et al. (2025), modelling standard co-authorship at the French NSB as an inter-organisational knowledge network, find that firms in brokerage positions show higher subsequent innovation output, while the number of co-authoring partners is not significantly associated with it. The authors attribute the effect to position and knowledge diversity. Transferred with caution to an entry-level pathway, the finding suggests teaching an entrant to decide where to take part, at which level and with which partners, and what the organisation wants a standard to achieve. The pathway reported here prepares that decision: modules N1 to N3 address KA1 to KA3, and strategic participation in standards development (KA4) is the target of the advanced module N4. The sources in this section are design rationale and not evidence about the pilot, since they analyse firms, patents and professionals rather than learners.

2.5 Kirkpatrick's model and what each level of evidence can show

The evaluation of Normung Insight 2.0 follows the Kirkpatrick four-level framework (Kirkpatrick & Kirkpatrick, 2016). Level 1 (Reaction) captures satisfaction, perceived

relevance, and engagement; Level 2 (Learning) captures change in knowledge, skills, attitudes, confidence, and commitment; Level 3 (Behaviour) captures application in the working context; Level 4 (Results) captures organisational and societal outcomes. The model is not uncontested: the causal chain it implies and the weight it gives to reaction data have been questioned since Alliger and Janak (1989), by Holton (1996) and by Bates (2004). It is used here as a reporting grid that keeps categories of evidence apart, not as a causal model, and the paper states at which levels it produced no data at all.

Five categories are kept apart throughout. Reaction data are reported in Sections 4.1, 4.2, 4.4, 4.6 and 4.7. Post-training self-rated confidence on the Intended Learning Outcomes is reported in Section 4.3; it is an indicator related to Level 2. Measured learning was not assessed: the pre- and post-training checks foreseen in the evaluation architecture committed to ex-ante (Bulc, 2026) were not deployed in the first pilot. Behavioural intention is reported in Section 4.6 as a stated next step, recorded on the training day by four submissions and four weeks later by two. Actual behaviour was not assessed, and neither were Level 4 results; both require the follow-up instruments foreseen ex-ante and a longitudinal window that had not opened at the time of writing.

2.6 Blended and flipped learning

The three-component architecture, a self-paced online module preceding two in-person modules on a single training day, instantiates the blended-learning logic of Garrison and Kanuka (2004) and Graham (2006), with core conceptual input shifted online to free face-to-face time for application and feedback, in the flipped form described by Bishop and Verleger (2013). Standardisation education adds three didactic specificities to that generic logic: consensus-building must be experienced rather than described, the participant's own future role as a committee actor must be made tangible, and the value tensions intrinsic to standardisation, transparency against confidentiality of drafts and openness against the expertise meaningful participation requires, must be surfaced rather than smoothed over (Bulc, 2026). The first two points have precedents in the field: at the Rotterdam School of Management the elective opens with a role-playing game in which each student negotiates in a standardisation committee, so that the core issues are experienced before they are treated analytically (de Vries, 2020a, p. 60), and across the cases collected in the same volume de Vries (2020b, p. 213) concludes that teaching methods matter more than teaching materials, with active involvement of the learner as their common denominator.

2.7 The intended learning architecture

Table 1 summarises the mapping between the four value clusters used in this pathway, the layer of the framework each cluster draws on, the ITCoS Knowledge Area addressed, and the learning activities foreseen in the design. Two distinctions matter for reading it. First, the four value clusters are not identical with the principles of the standardisation system. Module N2 presents four fundamental principles taken from the rules of procedure, transparency, openness, consensus and coherence, which correspond to four of the seven sections in which those rules set out the principles of the system (Austrian Standards International, 2022, sections 2.2, 2.3, 2.4 and 2.7); teaching four is a deliberate reduction. Second, the framework does not publish a four-cluster taxonomy. Its value layer is anchored in the five core values of Article 2 of the Treaty on European Union, and responsibility and autonomy is the heading of its fourth column (Veljanova, 2025, pp. 28, 29, 32). The four clusters are an operationalisation prepared for this pathway, following the conference version (Bulc, 2026) and drawing the cluster terms from the published framework literature (Jakobs, 2020; Mosakas et al., 2025, pp. 3, 10). What is specific to this pathway is the grouping into four and the decision to carry each cluster on a system

principle an entry-level participant can observe directly: the public comment register for transparency, the participants list for openness, the decision rule for consensus, and, for the fourth cluster, what the participant brings rather than what the system offers. Each cluster is carried on concrete elements, and the value vocabulary recurs across modules; this repeated exposure becomes a limitation for the interpretation of the value items in Section 4.5.

Table 1: Intended learning architecture of Normung Insight 2.0 (based on Bulc, 2026). The activities listed are those foreseen in the design; Section 3.1 records which of them were reduced or not run in the first pilot.

Value cluster	Framework layer drawn on	ITCoS Knowledge Area	Learning activity foreseen in the design
Transparency of procedures and decisions	Transparency, process visibility	KA1 (N1)	Simplified process diagrams; role descriptions for committee members; guided walk-through of comment submission
Openness and inclusion	Openness, inclusion	KA1 (N1), KA2 (N2)	Narrative elements (e.g. a newcomer from a small or medium-sized enterprise); short videos with contributors; accessible language and examples
Consensus and participation	Consensus building	KA2 (N2)	Short negotiation exercise: small groups agree on a simplified standard under time pressure and conflicting interests, followed by a structured debrief
Responsibility and autonomy	Responsibility, autonomy	KA3 (N3)	'I can…' statements linked to Intended Learning Outcomes; guided reflection on individual next steps

3 Method

3.1 The delivered artefact, described following Choi and de Vries

The design is described along the five components proposed by Choi and de Vries (2011) and applied to national cases by Vasileva (2020, p. 89): target group (who), learning objectives (why), programme operator (where), content modules (what) and teaching methods (how). Three states are kept apart throughout: the ex-ante design, the departures from it that are documented at the design stage in the course plan, and the actual delivery, which was not independently observed.

Who. The target group is the one described in Section 1, professionals who enter standardisation as committee experts. The pathway assumes no prior technical specialisation and is not designed for students in degree programmes.

Why. The learning objectives are the twelve Intended Learning Outcomes reported in Section 4.3, derived from the value-based framework and mapped to Knowledge Areas KA1 to KA3. When the predecessor seminar was reduced, content was retained only where it mapped onto a value-based Intended Learning Outcome and served one of three competence layers: understanding what standards are, recognising who shapes them and how, and identifying a

concrete next step for one's own participation (Bulc, 2026). The rule removed extended legal genealogies, exhaustive committee lists and long chronologies and added narrative, people-centred elements and an explicit vocabulary of standardisation values. KA4 is the target of the advanced module N4, which had not run at the time of writing.

Where. The programme operator is the NSB itself, not a university, which differs from most cases documented in the literature (Puiu, 2020, p. 102; Vasileva, 2020) and shapes the constraints: participants attend during working time, and the format competes with operational duties. At the end of 2025, 5,034 people participated in committees through Austrian Standards International, 435 of them newly nominated, on the nomination of 3,018 organisations (Austrian Standards International, 2026a). University teaching by staff of the organisation (University of Graz, 2026) is a separate channel, and no claim in this paper transfers to it.

What. The pathway is offered publicly in two parts: Part I, the E-Learning module How standards shape our world (Wie Standards unsere Welt gestalten), and Part II, the in-person day Roles and processes of standardisation (Rollen und Prozesse der Normung) (Austrian Standards International, 2026g). Internally, N1 denotes Part I, and N2 and N3 denote the morning and afternoon modules of Part II. Module N1 comprises a self-paced core of approximately 45 minutes and an optional deepening phase of approximately 75 minutes, both in German; it is marked complete when the content chapters have been opened and the concluding test passed. Module N2 covers roles and committee bodies, the national development process, the national, European, and international levels, the consensus principle, public commenting, and committee tools; module N3 covers conformity, market and innovation perspectives, market surveillance under Regulation (EU) 2019/1020, risk reduction, stakeholder perspectives and the strategic value of committee participation. The ordering, national process before the European and international levels, follows the sequencing rationale of de Vries (2020a, p. 64).

The national process content of module N2 follows the Austrian rules of procedure (Austrian Standards International, 2022, sections 4.1, 4.4.3, 4.4.5, 4.4.7 and 4.5.3), including the right of any person to request a project, the public commenting period and the periodic review of standards in force. Drafts can be assessed and commented on free of charge through the public draft portal during the commenting period.

How, and the documented departures from it. The three modules are described from the sources available for each: N1 from the platform build and screenplay, N2 from the handout, the slides and the detailed curriculum, N3 from the detailed curriculum. The sources are not symmetrical: N1 and N3 have a scene-level document with timings, whereas N2 has a block-level handout, a slide set without timings per element and a curriculum that records departures, which bounds and shortens the account of its didactic form below.

Module N1 was developed by the author with an external E-Learning agency and implemented by the Austrian Standards Academy of Austrian Standards plus Ltd., a wholly owned subsidiary of Austrian Standards International (Austrian Standards International, 2026h). It follows a single fictitious protagonist, a young entrepreneur new to standardisation, and orders its content by the objections the protagonist raises, the person-centred entry point that Fomin (2020, pp. 31, 36) describes. Video situations alternate with content slides and two drag-and-drop interactions with differentiated feedback, and the core closes with a five-item formative checkpoint. The deepening phase pairs seven source documents with reflection questions, among them the value-based framework paper (Mosakas et al., 2025) with the prompt to identify the European core values (original German: „europäische Grundwerte“) and explain why they matter for standardisation, and closes with the concluding test. Checkpoint and test are instructional and completion devices: neither has a baseline nor was designed as a validated pre- or post-measure, and item-level results were not available for analysis.

Module N2 was designed as presentation combined with guided tool use, structured in five blocks across the morning (Austrian Standards International, 2026d), and Table 1 foresees a short group exercise on consensus formation for it. Its procedural content follows the Austrian rules of procedure and the published account of how ÖNORMEN, the Austrian national standards, are created (Austrian Standards International, 2022; Grün, 2015). The detailed curriculum (Austrian Standards International, 2026b) marks three departures for the pilot: the planned commenting workshop was replaced by frontal presentation; a think-pair exercise on roles in the committee, set on the election of the chair, was dropped; and the committee platform was presented frontally in about three minutes. A fourth departure is an absence: the short negotiation exercise that Table 1 assigns to the consensus cluster appears neither in the curriculum nor in the slides of the module (Austrian Standards International, 2026b, 2026j), and no other group exercise on consensus formation takes its place. The materials record no reason for this. The module as planned in the curriculum was therefore predominantly presentational. The curriculum gives time and group size as its reasons: the commenting workshop and the think-pair exercise were considered difficult to run with seven participants in the minutes available. The curriculum states no reason for the other two departures. The curriculum reduces the consensus topic in form and keeps it in substance: it presents the principle as content, together with the decision rules from simple and three-quarter majority to unanimity and weighted voting (CEN-CENELEC, 2026b); what is missing is the exercise in which participants would have experienced consensus formation themselves, the element Mijatović (2020, pp. 202, 204) names as the appropriate method for this content.

Module N3 is documented as a serious game, the only simulation in the pilot, and operates at the level of strategic decision rather than standard drafting. The detailed curriculum (Austrian Standards International, 2026c) sets out seven phases across 195 net minutes: each participant selects a practice project of their own; four groups take stakeholder roles (large enterprise, small or medium-sized enterprise, authority, consumer-protection body) with prescribed objectives; each role chooses one of three conformity strategies and justifies it in writing. After a break, three event cards stress-test the chosen strategy; a plenary debrief records who changed course, which event triggered the change and which EU value was invoked (original German: „Welcher EU-Wert?“), with the slide cueing safety, fairness, sustainability and transparency, EU values in the wider sense noted in Section 2.3; and each participant completes an individual action card, followed by the feedback questionnaire. In the first pilot, the curriculum records no departure from the simulation; in an interim iteration on 14 October 2026 it was replaced (Section 5.3.2). Of the four roles, the consumer-protection body is the societal stakeholder. The role set is consistent with cohort size, since the curriculum divides seven participants into four groups of one or two (Austrian Standards International, 2026c), and covers the economic, public and consumer side of the conformity question the game turns on. Organisations representing environmental and social interests, which Regulation (EU) No 1025/2012 (2012, Article 5 and Annex III) recognises alongside consumer and small-business organisations as stakeholders in European standardisation, are not represented, which limits the range of value tensions the game can surface.

3.2 Pilot and cohort

The first pilot ran in May (N1) and June 2026 (N2 and N3) with seven participants (N = 7) recruited through the regular training channels of Austrian Standards International. The instruments were anonymous and recorded no demographic or organisational data, which with seven participants would also have carried a re-identification risk, so the cohort is described by size and recruitment channel only. The instrument for the second pilot collects gender and type of organisation as optional items, reported in aggregate.

The in-person day took place on 24 June 2026 in Vienna, with module N2 in the morning (180 minutes of net instruction) and module N3 in the afternoon (195 minutes) (Austrian Standards International, 2026b, 2026c). Each module was delivered by a different committee manager of the organisation; the author designed the pathway and did not deliver it. Normung Insight denotes the predecessor seminar, Normung Insight 2.0 the redesign, and Standardization Professional the commercial label under which the day was delivered and the feedback instrument headed. The in-person instrument was issued at the end of the day and remained open; one reminder went to all seven participants on 20 July 2026 (Austrian Standards International, 2026f), and the data set was closed on 21 July 2026. Delivery was not observed and no fidelity record exists, so all statements about delivery rest on the curricula, the course materials and the participant instrument.

3.3 Instruments

Two instruments were deployed online, designed by different people: the instrument for module N1 by the member of the Austrian Standards Academy who implemented the module, the in-person instrument by the author. No common scale convention was agreed, and the two instruments used opposite scale directions (Section 5.3.3). The complete item wording is given in Supplementary Material A.

The online instrument, presented after completion of module N1, comprised three closed items on a verbal agreement scale, one recommendation item and one free-text item. The agreement scale is numbered in descending order, with 1/trifft völlig zu (fully applies) as the best value and 2/trifft eher zu (rather applies) as the next; only these two steps occur in the data, so the number of steps cannot be established from the export. The recommendation item names 10 as the best value but records no lower endpoint, so the two recommendation items are reported separately. All online respondents had completed the core and the deepening phase, in which the value-based framework is presented explicitly, and passed the concluding test before the instrument was presented (Austrian Standards International, 2026i).

The in-person instrument, headed Standardization Professional Seminar-Feedback, introduced as fully anonymous and issued at the end of the training day, comprised 13 questions in five sections: three overall rating items on the training day, the trainer and the course materials. Each in-person module then had one multiple-choice item on perceived topic relevance capped at three selections out of six, six Intended Learning Outcome self-ratings on a three-point scale whose every point carries a verbal anchor (1 = noch unsicher, still unsure; 3 = teilweise, partial; 5 = sicher, confident), and one free-text item. Further items were four value-cluster items on the same three-point structure (1 = nicht deutlich, not clear; 3 = teilweise, partial; 5 = deutlich, clear); one free-text item on values; one recommendation item on a scale from 0 to 10 with both poles verbally labelled; and one multiple-choice follow-up item offering five options, one of them an explicit opt-out, capped at four selections.

The three overall rating items are the exception: they presented the bare numerals 1 to 5 with no verbal anchor and no legend, whereas every other rating item in the form carries verbal labels. Section 4.2 reports the consequences.

Response was voluntary. Four of seven participants responded to the online instrument (n = 4, 57.1%). Six submissions were returned to the in-person instrument: four on the training day and two on 20 and 21 July 2026, 26 and 27 days later and within 24 hours of the reminder. The reminder also reached those who had already responded, and the form recorded no identifier, so 85.7% is an upper bound on the response rate and the six submissions cannot be verified as coming from six distinct participants. The labels O1 to O4 and P1 to P6 denote submission order within each instrument and are not comparable across the two.

3.4 Anonymisation and ethical protocol

The instrument opened with a written statement that the feedback was fully anonymous, that neither name nor e-mail address would be recorded, and that it served the further development of the seminar. The data export confirms this: the name and e-mail fields are empty or marked anonymous for every response to both instruments. The evaluation was conducted as part of routine course improvement. Participation was voluntary, and the instruments collected no names, e-mail addresses or sensitive categories.

3.5 Translation protocol

Items and verbatim feedback were in German, the language of the pilot. Translations into English were prepared by the author and are marked as such; the original German wording is retained alongside each quoted passage.

3.6 Analytic approach

Given the cohort of seven and the submission counts of four for the online instrument and six for the in-person instrument, the analytic approach is descriptive and formative. No inferential statistics are computed. Item-level distributions are reported in full, with raw counts as the primary reporting form and percentages, where given, in parentheses. Where a distribution is affected by the two submissions returned after the reminder, the same-day subset is reported alongside the full set rather than in place of it. Means are reported only for the recommendation items; for the Intended Learning Outcome items, Section 5.1 states what a mean can denote on a three-point scale whose points are 1, 3 and 5.

3.7 Limitations of the method

Nine limitations bound the interpretation and are stated once here. First, the cohort is small (N = 7) and response partial (57.1% online; at most 85.7% in person); response was voluntary, and self-selection towards the more satisfied participants cannot be excluded. Second, the Intended Learning Outcome and value items are self-ratings collected once, without the pre- and post-training checks foreseen ex-ante (Bulc, 2026), so they evidence a post-training level of self-rated confidence, not a learning gain or demonstrated competence. Third, these items offer three steps and no option between partial and full confidence. Fourth, the three overall rating items lack verbal anchors and are not interpretable (Section 4.2). Fifth, Kirkpatrick Levels 3 and 4 lie outside the observation window. Sixth, delivery was not observed; what is documented is the set of design-stage departures recorded in the curriculum (Section 3.1). Seventh, the pilot ran in one national context and one language, and the pathway, the in-person instrument and the analysis are the work of a single author, without independent coding of open-ended responses; no cohort characteristics were recorded, so no subgroup reading is possible. Eighth, two in-person submissions were returned four weeks after the event and carry a recall component the others do not. Ninth, repeated participation by one person cannot be excluded, so no submission count is treated as a count of distinct individuals.

Coverage is bounded rather than complete. Gender responsiveness is named as a criterion for evaluating pilots developed under EDU4Standards.eu (Mosakas et al., 2025, p. 6, note 7), and neither the pathway nor the instrument reported here addresses it. The same applies to green and digital skills, which the framework treats as a distinct part (Veljanova, 2025, p. 26). The pilot covers the value part of the framework and not the skills part: the green and digital skills component is intended to be addressed through module N4, while gender responsiveness is a property of the evaluation design and enters the second-pilot instrument.

4 Results

Section 4 reports the data in the order of the participant journey. All figures rest on four online responses and six in-person submissions from a cohort of seven. P5 and P6 denote the two submissions returned after the reminder; where they affect a distribution, the same-day subset is reported alongside it. The limitations of Section 3.7 apply throughout.

4.1 Reaction data: the online module N1

All four respondents rated the technical performance of the online module at the top of the scale (trifft völlig zu). Content expectations and the learning experience were rated at the top by two respondents and one step lower (trifft eher zu) by the other two (Table 2).

Table 2: Online module reception, first pilot (n = 4). Scale: verbal agreement scale numbered in descending order, best value 1/trifft völlig zu; the number of steps below the second is not established from the export (Section 3.3).

Item	Fully applies (best)	Rather applies	Lower steps
The online module worked without technical problems	4	0	0
The online module met my content expectations	2	2	0
The online module provided an engaging, stimulating learning experience	2	2	0

One free-text response addressed the design intent of the module directly: O4 wrote that the short videos with the various contributors were much appreciated, because it is about people (original German: „mir haben die kleinen Videos mit den unterschiedlichen Mitwirkenden sehr gefallen, denn es geht um Menschen“). The comment names the narrative, person-centred access to the standardisation process that the module was designed around (Bulc, 2026).

4.2 An uninterpretable item block

Three items asked participants to rate the training day, the trainer and the course materials on the bare numerals 1 to 5 (Section 3.3). Table 3 reports the raw values as submitted.

Table 3: In-person day, three overall rating items (six submissions). Raw values as submitted; the scale carried no verbal anchors, and the values are not aggregated. The right-hand column repeats each submission’s rating on the verbally anchored recommendation item of the same form.

Submission	Overall course day	Trainer competence and delivery	Materials quality and clarity	Recommendation rating (0 to 10, both poles labelled)
P1	3	3	4	6
P2	1	1	1	10
P3	5	5	4	10
P4	1	1	1	10
P5	2	2	2	8
P6	1	1	1	10

These responses cannot be aggregated. The survey tool's rating items ascend, so that 5 denotes the highest value, whereas the Austrian school grading convention familiar to the cohort runs the other way, with 1 as the best grade. The same form is consistent with respondents having read the block in opposite directions: the three submissions scoring 1 on all three items and the submission scoring 5, 5 and 4 all gave the maximum of 10 on the recommendation item, which is labelled at both poles, and the submission scoring 2 throughout gave 8. The contradiction lies within individual response sets and does not separate satisfied from dissatisfied participants. The block is neither reverse-scored nor reconstructed, and no reception claim is derived from it. Internal reporting of the pilot read the block as a grade, under the heading Note 1-5 (grade 1 to 5) with the legend 1 = sehr gut (very good), 3 = befriedigend (satisfactory), 5 = genügend (sufficient), which the deployed form does not contain; this shows how readily the block invites a grading interpretation.

The finding is transferable. Where an evaluation instrument is deployed in a national context with an entrenched grading convention, an unlabelled numeric rating item is not neutral, and verbal anchors at both poles are a precondition for interpretability. The instrument for the second pilot carries them on every rating item.

4.3 Post-training self-rated confidence on twelve Intended Learning Outcomes

The twelve items record how confident respondents felt after the training day, an indicator related to Kirkpatrick Level 2 and not a measure of learning gain (Section 2.5). The lowest point of the scale, 1 = noch unsicher (still unsure), was selected by no respondent on any of the twelve outcomes.

4.3.1 Module N2, morning

Six Intended Learning Outcomes covered roles, the national development process, the national, European, and international levels, the consensus principle, public commenting, and committee tools. Of 36 ratings, 25 (69.4%) were at 5 = sicher (confident) and 11 (30.6%) at 3 = teilweise (partial); in the same-day subset the corresponding figure is 16 of 24 (66.7%). The three lowest-rated outcomes, the same three as in the same-day subset, are finding one's way around the committee tools, rated confident by two of six, and naming and distinguishing the roles in standardisation and knowing the function of the public commenting procedure, each rated confident by four of six. Table 4 reports the full distribution.

Table 4: Module N2, Intended Learning Outcome self-ratings (six submissions). Scale: three points, all verbally anchored (1 = noch unsicher, still unsure; 3 = teilweise, partial; 5 = sicher, confident). No respondent selected 1 on any item.

Morning Intended Learning Outcome	P1	P2	P3	P4	P5	P6
Name and distinguish key roles in standardisation	3	5	3	5	5	5
Understand national standard development from idea to publication	5	5	5	5	3	5
Distinguish national, European and international standardisation	5	5	3	5	5	5
Explain the consensus principle in a committee	3	5	5	5	5	5

Morning Intended Learning Outcome	P1	P2	P3	P4	P5	P6
Know the function of public commenting in standardisation	5	3	3	5	5	5
Find one's way around committee tools	3	5	3	5	3	3

The three outcomes with the fewest confident ratings require an act rather than awareness, while the outcomes covering the development process and the three levels carry the highest ratings. The pattern holds in the same-day subset. Section 5.2 sets it against what the curriculum records as delivered.

4.3.2 Module N3, afternoon

Six Intended Learning Outcomes covered the three strategic perspectives (conformity, market, innovation), conformity presumption under harmonised standards, market surveillance, risk reduction, stakeholder perspectives and the strategic value of active committee participation. Of 36 ratings, 26 (72.2%) were at 5 = sicher and 10 (27.8%) at 3 = teilweise; in the same-day subset the corresponding figure is 22 of 24 (91.7%). The lowest-rated outcome is distinguishing the three strategic perspectives, rated confident by three of six. Eight of the 12 ratings returned by P5 and P6 on this module were below the top point, against two of 24 in the same-day subset. Table 5 reports the full distribution.

Table 5: Module N3, Intended Learning Outcome self-ratings (six submissions). Scale: three points, all verbally anchored (1 = noch unsicher, still unsure; 3 = teilweise, partial; 5 = sicher, confident). No respondent selected 1 on any item.

Afternoon Intended Learning Outcome	P1	P2	P3	P4	P5	P6
Distinguish three strategic perspectives (conformity, market, innovation)	3	5	5	5	3	3
Understand the principle of conformity presumption with harmonised standards	5	5	5	5	3	3
Situate the role of market surveillance under Regulation (EU) 2019/1020	5	5	3	5	3	5
Describe how standards reduce risks (safety, liability, supply chain)	5	5	5	5	3	5
Distinguish stakeholder perspectives (manufacturers, consumer protection, authorities)	5	5	5	5	3	5
Justify the strategic value of active committee participation	5	5	5	5	3	5

The afternoon distribution is flatter, with one outcome standing out: distinguishing the three strategic perspectives, the conceptual frame introduced at the start of the module, carries the fewest confident ratings, whereas the remaining five outcomes, which concern roles, procedures and consequences, each carry four or more confident ratings.

Over the full set the two modules are close, with 25 and 26 of 36 ratings at the top point. In the same-day subset they diverge, 16 against 22 of 24, and in the delayed pair the order reverses, nine against four of 12. The modules differed in content, facilitator, method (presentation and a serious game) and documented practice opportunities (Section 3.1), and the morning preceded the afternoon. Delivery was not observed, so neither the divergence nor its reversal can be attributed to any of these factors or to elapsed time, and the distributions are compared descriptively only.

4.4 Perceived topic relevance

Two multiple-choice items asked which topics of each module were most helpful for the respondents' own practice. Both items capped selection at three of six options, so the counts are bounded by design; a topic not selected was not thereby rejected. For module N2, roles in standardisation, national and international bodies, and committee tools were each selected by four of six submissions; the sequence from project idea to published standard by three of six; public commenting and appeal procedures by two of six; the consensus principle and voting procedures by one of six. For module N3, strategic participation in committees was selected by five of six submissions; conformity presumption under harmonised standards and standards as an instrument of risk reduction by three of six each; market access and market surveillance under Regulation (EU) 2019/1020 and stakeholder perspectives by two of six each; standardisation as an instrument of innovation by one of six. With six submissions and a capped format, these counts support no ranking of topics and are reported as descriptive input for the second pilot.

4.5 Value-cluster items

Of the 24 value-cluster responses, four clusters by six submissions, 23 were at the top point of the three-point scale. The single exception is the responsibility and autonomy cluster, rated partial by P5. Table 6 reports the distribution.

Table 6: Value-cluster items (six submissions). Scale: three points, all verbally anchored (1 = nicht deutlich, not clear; 3 = teilweise, partial; 5 = deutlich, clear). No respondent selected 1 on any item.

Value cluster	P1	P2	P3	P4	P5	P6
Transparency of procedures and decisions	5	5	5	5	5	5
Openness and inclusion towards all interested parties	5	5	5	5	5	5
Consensus and participation as basis of standardisation	5	5	5	5	5	5
Responsibility and autonomy of contributing experts	5	5	5	5	3	5

This is a perception-level signal and is not read as evidence that the values were understood or applied. The value vocabulary reached the participant at up to five documented points before the items were answered: the N1 principles slide, the N1 checkpoint, the N1 deepening phase, which pairs the value-based framework paper with the prompt to identify the European core

values, module N2 (Austrian Standards International, 2026d), and the module N3 debrief, whose slide cues four values, about twenty minutes before the questionnaire (Austrian Standards International, 2026c). Recognition of familiar terminology, the recency of the debrief and a ceiling effect therefore plausibly act in the same direction; for the two delayed submissions, recall takes the place of recency.

The evaluation design adds a circularity. The value-based framework (Mosakas et al., 2025) is a theoretical source of this paper, content taught in module N1, and the source of the value clusters the instrument asks about. An item of that construction cannot separate the clarity of a value from the recognition of a term, however participants answer. Two observations are difficult to reconcile with items that discriminate: the responsibility and autonomy cluster was not taught under that name yet received the top rating from five of six submissions, and the consensus cluster received it from all six although the group exercise designed to carry it appears neither in the curriculum nor in the slides (Section 3.1).

Three open-ended value reflections were provided. P2 summarised the day as “independent, open, safe” (original German: „Unabhängig, offen, sicher“), P3 named “responsibility towards the consumer and the general public” (original German: „Verantwortung dem Konsumenten bzw. der Bevölkerung gegenüber“), and P6 named “the scope for shaping that comes with it; safety” (original German: „die damit verbundene Gestaltungsmöglichkeit; Sicherheit“). All three name concrete referents rather than abstractions, and the third names participation as a possibility of influence. Three responses do not establish how the remaining submissions read the items.

4.6 Recommendation ratings and stated next steps

The two recommendation items are reported separately. For the online module, the four ratings were 6, 6, 10 and 10 (mean 8.0) on a scale whose lower endpoint is not established (Section 3.3). For the in-person day, on a scale from 0 to 10 labelled at both poles, the six ratings were 6, 8, 10, 10, 10 and 10 (mean 9.0); the two delayed ratings were 8 and 10. The ex-ante plan named these items a Net Promoter Score (Bulc, 2026); with four and six responses the score cannot be computed meaningfully and is not reported.

All six in-person submissions selected active committee participation as a next step; four of six additionally selected the advanced course N4 and four a thematic webinar; two selected a personal conversation with a contact at the organisation. The item also offered an explicit opt-out, no further step planned at present, which no submission selected. In both administration windows this is a stated intention; behaviour was not observed. In the terms of the framework, that intention points at KA4, strategic participation in standards development, which none of the three delivered modules addresses.

4.7 Free-text responses

Free-text responses were returned for the module N2 prompt and the value prompt, three on each; the module N3 prompt received no entries. P2 wrote “Excellent lecturer!!! Thank you” (original German: „Tolle Vortragende!!! Danke“). P3 named the overview of the ÖNORM, EN and ISO systems as particularly useful and asked for a larger font, less text per slide and an agenda for the afternoon (original German: „Besonders nützlich war die Übersicht der unterschiedlichen Normsysteme sprich ÖNORM, EN und ISO. Ich würde nur vielleicht die Schriftgröße von den Folien etwas vergrößern bzw. vielleicht weniger Text drauf, sprich mehr Folien. Sonst wäre es nur noch gut eine Agenda für den NM auch noch zu haben. Sonst voll der super Kurs!“). Asked what should be added to the morning module, P6 answered: “examples, navigating in the portals” (original German: „Beispiele, das Navigieren in den

Portalen“). That request is consistent with the two elements the curriculum records as reduced for this module, the commenting workshop and the guided use of the committee platform (Section 3.1), and the corresponding outcome carries the lowest confidence rating of the twelve (Section 4.3.1). Whether the reflection element at the end of module N3 ran is not documented, so the empty N3 prompt is reported without explanation.

5 Discussion

5.1 The ex-ante rationale confronted with the first pilot signal

Three numbered sets recur below and are kept distinct: the five ex-ante design decisions and the four tentative design principles set out in the practitioner paper (Bulc, 2026), and the five items that the first pilot yields for the second pilot (Section 5.3). The five ex-ante decisions were to reorganise a dense expert-led seminar into a blended pathway, to map the internal audience segments onto ITCoS Knowledge Areas, to operationalise four value clusters in concrete learning activities, to shift face-to-face time from lecture to simulation, role play and guided tool use, and to commit to a four-level evaluation architecture. Table 7 confronts the ex-ante commitments with the first-pilot signal, the limitation or alternative explanation attaching to each, and the status after the pilot.

Table 7: Ex-ante commitments confronted with first-pilot signals (N = 7; n = 4 online, six submissions in person). No entry in this table asserts a measured effect.

Ex-ante commitment	Pilot signal	Limitation or alternative explanation	Status after pilot
Explicit value clusters should anchor learning alongside process content (Bulc, 2026)	Twenty-three of 24 value-cluster ratings at the top point; one partial rating on the responsibility and autonomy cluster; three open-ended reflections named concrete referents	Repeated exposure to the terminology; immediate recency for four submissions and retrospective recall for two delayed submissions; a strong ceiling effect. The items cannot distinguish recognition, understanding and application	Not tested; the item set produced almost no variance
Micro-modules enable tailoring for different learner profiles (Bulc, 2026)	The only related item, technical performance of the online module, was rated at the top by all four respondents	An item without variance discriminates nothing; no item addressed tailoring, unit length or recombination	Not tested
An explicit value vocabulary aligns internal stakeholders and	No item in either instrument addressed this proposition	The proposition concerns internal stakeholders and institutional	Not addressed by the instrument

Ex-ante commitment	Pilot signal	Limitation or alternative explanation	Status after pilot
makes the contribution to European policy goals visible (Bulc, 2026)		visibility, which a participant instrument cannot observe	
Deliberately surfacing the value tensions specific to standardisation distinguishes it from generic blended learning (Bulc, 2026)	No item in either instrument addressed this proposition	The instrument asked whether the four value clusters had become clear, not whether the tensions between them had become visible	Not tested; no item addressed it, so the gap lies in the instrument
Shifting face-to-face time from lecture to simulation, role play, and guided tool use improves the reception of operational content (Bulc, 2026)	25 of 36 confidence ratings at the top point for module N2 and 26 of 36 for module N3; 16 of 24 against 22 of 24 in the same-day subset	The modules differ in content, facilitator, sequence, method, and documented practice opportunities; delivery was not observed, and no fidelity record exists	Not tested as a causal proposition; the difference is descriptive

The first four rows are the tentative design principles of Bulc (2026); the fifth is one of the five ex-ante design decisions. Two further ex-ante decisions need separate comment. The mapping of audience segments onto Knowledge Areas was revised during implementation: the ex-ante mapping positioned the offering at the KA1 to KA2 interface with brief signposting towards KA3, whereas the delivered pathway assigns KA1 to module N1, KA2 to module N2 and KA3 to module N3 as a stand-alone serious game; the post-training ratings neither contradict nor test the widened scope. Because no respondent selected 1 and the scale offers no value between 3 and 5, each item mean is a linear restatement of the share of ratings at the top point of the self-rating scale, 5 = sicher (confident) (Section 3.3): the mean equals $3 + 2p$, where p is that share. The discrete distribution in Tables 4 and 5 remains the primary reporting form. The evaluation architecture was realised only in part: only the reaction items and the post-training self-ratings were deployed, and the instrumentation that did run produced two findings it was not designed to produce, on anchoring (Section 4.2) and on the administration window (Section 3.3).

5.2 Where confidence in module N2 sits lower

Three Intended Learning Outcomes in module N2 carry the lowest confidence ratings of the six: finding one's way around the committee tools, rated partial by four of six submissions, and naming and distinguishing the roles in standardisation and knowing the function of the public commenting procedure, each rated partial by two of six. The same three outcomes are lowest in the same-day subset, so the pattern does not depend on the two delayed submissions. All three can be read as outcomes of operational competence rather than of awareness, and they sit at the handover from KA1 to KA2, where knowing that committees, procedures, and tools exist

must become the ability to use them. Two of the three concern the acts through which participation becomes possible in the Austrian system, commenting on a draft and operating the committee platform. This matters beyond the classroom, because drafts are open for comment free of charge and to any external person (Austrian Standards International, 2022, p. 7, section 4.4.7), so what stands between an entry-level participant and the first act of participation is plausibly a competence barrier, which such a pathway is meant to lower.

The course plan documents some correspondence for these three outcomes. The detailed curriculum for module N2 (Austrian Standards International, 2026b) marks that the planned commenting workshop was replaced by frontal presentation, that the think-pair exercise on roles was dropped, and that the committee platform was presented frontally in about three minutes; the practice element associated with each of the three lowest-rated outcomes was therefore recorded as reduced or omitted at the design stage, before any question of delivery arises. One free-text response is consistent with the same gap, although the prompt did not ask about practice elements: asked what to add to the morning, P6 named examples and navigating in the portals (Section 4.7). This is a documented correspondence at element level, not proof of causation. With six submissions, single response patterns still move the distribution. Two further readings remain open: that roles are introduced in module N1 as people and in module N2 as process categories and the two representations may not yet connect, and that content difficulty rather than method may account for the ratings. The consensus outcome shows the limit of this reading. The design assigns a group negotiation exercise to module N2, and neither the curriculum nor the slides contain one, yet five of six submissions rated the outcome confident. That outcome asks participants to explain the principle, which the slides cover as content, whereas the three lowest-rated outcomes ask them to act; the absence of practice thus coincides with lower confidence where an act is required, not where an explanation suffices.

5.3 What the first pilot yields for the second pilot

The items below are of three kinds and are not equivalent claims. One is a pedagogical hypothesis derived from the first-pilot data; one is an implementation lesson; three are corrections to the evaluation instrument. None is a validated transferable recommendation, and each names the evidence it rests on and the evidence it lacks.

5.3.1 Pedagogical hypothesis

H1. Treat operational competence as a hands-on segment, not a slide segment. The three lowest-rated outcomes concern what a participant does rather than what a participant knows; the practice elements associated with all three outcomes were recorded in the curriculum as reduced or omitted (Sections 3.1 and 5.2), and one submission asked for examples and portal navigation when invited to suggest additions (Section 4.7). A documented format exists for the commenting outcome: Van den Bossche (2020, pp. 24 to 25) has engineering students reconstruct the genesis of a published standard from the complete project file, working through the national committees' comments and their resolution. Transposed to a professional half-day, the equivalent is a guided walk-through of one Austrian draft currently open for public comment, a route the organisation's own material already specifies, since drafts are open to any external person during the commenting period (Austrian Standards International, 2022, section 4.4.7) and the comment format requires a comment table, a classification of each comment, a reason and a concrete change proposal (Austrian Standards International, 2026e). The hypothesis is testable in the second pilot by restoring the element and comparing the corresponding item distributions.

5.3.2 Implementation lesson

L1. A pathway of this kind needs a delivery specification and a record of what was delivered, not only a curriculum. In this pilot the person who designed the curriculum and the persons who delivered it were different, as may often be the case at an NSB, and the design carried no instrument documenting delivery. The consequence is not that one difference in the data goes unexplained but that no distribution in this study can be related to what happened in either room. The point is visible where the data are most unstable: the gap between the two modules varies by subset (Section 4.3.2), and no reading of it can be tested, because no delivery-fidelity record documents what occurred in either module. Curricula document the intended design and the documented design-stage changes; they do not document actual delivery. This reads as a structural and organisational condition of the setting, and it would not be visible in curriculum-level descriptions alone. The corresponding measure is a delivery log completed during the session, phase by phase, as part of the course materials, together with a trainer qualification profile attached to the curriculum.

An interim iteration, delivered on 14 October 2026, bears on this lesson. On that date module N3 was delivered in place of the serious game as a trainer-led session combining presentation with plenary discussion, centred on participation in national, European and international committees, while the case underlying the game is revised on the basis of the existing didactic design; the game is planned to return in the iteration of May 2027. Because the design reported here was not run in full on 14 October, that iteration cannot test the items of Section 5.3, and the second pilot referred to throughout this paper is the iteration of May 2027. The module N3 outcome items used on 14 October were written for the simulation, so the data of that iteration will describe a different method from the one the instrument addresses. The iteration also suggests that a delivery specification needs, besides a delivery log, a documented route for adapting an agreed didactic design when circumstances change. The data of the interim iteration are not reported in this paper.

5.3.3 Instrument corrections

C1. Fix the direction and the anchoring of rating scales at the level of the pathway, not of the individual form. A four-level evaluation architecture was committed to ex-ante, but instrument design was not itself treated as a design object, and the two instruments were built by different people without a common convention. They run in opposite directions: the online agreement scale is numbered in descending order, so that 1 is the best value, while the in-person matrices and the recommendation item ascend. Within the in-person instrument, one block of three items carries bare numerals and no anchors at all, and that block produced the only uninterpretable data in the study (Section 4.2): the anchored items were interpretable, whereas the unanchored block was not. That unlabelled numeric scales invite divergent readings is consistent with survey methodology, where fully verbalised scales have been reported to yield higher reliability and validity than partially labelled ones (Menold, 2020; Menold & Bogner, 2016). What this pilot suggests is an organisational mechanism: where a pathway is evaluated through several instruments authored by different people, scale direction and anchoring are a coordination problem rather than an individual oversight, and an entrenched national grading convention running counter to the ascending default of the survey tool raises the cost of leaving it uncoordinated. The unanchored block belongs to the single in-person instrument and covers the training day as a whole, not either module.

C2. Close the administration window of a post-training instrument, or separate reaction items from confidence items. Sending a reminder to raise the response rate is common practice and was followed here by two further in-person submissions, lifting the count from four to six. The cost is that one form carried two kinds of item with different tolerances for delay. Reaction and

recommendation items are less tightly tied to an immediate post-session state than confidence items, although delayed administration still changes their temporal frame and should be reported explicitly; self-rated confidence at the end of a training day is tied to that state. The delayed pair collectively produced a less uniform confidence profile, driven particularly by one submission (Section 4.3.2). Delay, recall, subsequent experience and response-style differences cannot be disentangled with the data available, and no claim is made that elapsed time caused the difference or that the delayed submissions are less valid. The measure is either a fixed closing time for the confidence block, before the room empties, or two instruments, one closed on the day and one open to reminders.

C3. Evaluate value-based learning through situated application and value-conflict judgement, not through recognition or perceived clarity. The value items were the one ex-ante commitment the instrument addressed, and what they returned was an instrument finding rather than a learning finding. Twenty-three of 24 value-cluster responses were at the top point, so the item set produced almost no variance, showed minimal discrimination between clusters, including one not taught under its name, and displayed a strong ceiling effect; the recognition, recency and recall limitations of Section 4.5 apply in full. The value vocabulary reached the participant at up to five documented points before the items were answered, and the framework that supplies the clusters is at once a theoretical source of this paper and content taught in module N1, so the items ask whether a vocabulary the pathway has already presented, tested, and set as reading has become clear. An item of that construction cannot separate the clarity of a value from the recognition of a term, however the participant answers. Three free-text reflections named concrete referents, a perception-level observation from three submissions. What an instrument would need instead is a situated case in which two values conflict and the respondent must judge, administered before rather than after the closing value collection, so that the response records an application rather than a recall.

Three further ex-ante commitments remain without ex-post support and are stated as commitments, not findings: micro-modular tailoring, which rests on an item without variance; the use of an explicit value vocabulary to align internal stakeholders and make the pathway's policy contribution visible, which lies outside the participant instrument and requires a separate internal instrument; and the deliberate surfacing of standardisation-specific value tensions, which no item addressed. The third is the clearest gap in the instrument for the second pilot, since it is the element the conference version named as the distinctive contribution of a standardisation-specific pedagogy.

5.4 Limitations of the evidence

The limitations of Section 3.7 bound every claim above and are not restated here. With seven participants, at most six distinct respondents, one cohort, one institution and one country, the items in Section 5.3 are candidates for testing, and the second pilot is designed to test them rather than to reproduce established findings.

5.5 Relation to the wider field

Two connections situate this case. First, to the survey evidence on national standards bodies: Catalani Gabriel et al. (2022) document that such bodies widely acknowledge a responsibility for education about standardisation while differing in depth of activity, and Mijatović (2020, p. 192) observes that initiatives tend to start from scratch rather than build on documented work. A published item-level account of a single pilot, negative findings included, may serve as a small counterexample to that pattern. Second, to the destination of the pathway: all six in-person submissions selected active committee participation as their next step (Section 4.6), and the framework names that destination as its fourth Knowledge Area (Mijatović, 2025), which none

of the three delivered modules addresses. Given the share of small and medium-sized enterprises among nominating organisations (Section 2.4), the question of how such organisations position themselves across committees is not marginal. The EU Standardisation Strategy also foresees the valorisation of research and innovation through standardisation and pre-normative research, which suggests offering a pathway of this kind to researchers as a distinct audience, and Heß et al. (2025) suggest that position and knowledge diversity, rather than participation volume, are what matters. Whether an advanced module can teach position rather than procedure, and whether entrants are received into a professional community, which de Vries et al. (2020, p. 187) place among the tasks of standards bodies, are design questions this paper does not answer.

6 Conclusion

The most transferable yield of this pilot is likely to be the instrument design itself. The reception data lean positive but are bounded: recommendation ratings (6 to 10 on both items), value-cluster ratings and stated next steps were mostly high (Sections 4.5 and 4.6), but each is a reaction or an intention, recorded on the training day by four submissions and four weeks later by two, in a cohort of seven. The study does not establish training effectiveness, a learning gain or behaviour (Section 3.7).

Two implementation gaps were visible in the post-training data. The lower module N2 ratings concentrate on three outcomes of operational competence whose practice elements the curriculum records as reduced or omitted, gaps of the kind named in the 2019 to 2025 feedback on the predecessor course (Bulc, 2026), which the redesign targets and which the first pilot did not yet close for module N2. The second gap is in the instrument itself (Sections 4.2, 4.5 and 5.3.3).

Section 5.3 states the five items the pilot yields for the second pilot: one pedagogical hypothesis, one implementation lesson and three instrument corrections. They are hypotheses, offered to national standards bodies working within the same frameworks as candidates for testing, not as validated recommendations. The interim iteration of 14 October 2026 ran without the serious game (Section 5.3.2), and its data are not reported here. The revised design for the second pilot, planned for May 2027, restores a practice element in module N2, deploys an instrument with verbal anchors on every rating item, adds the pre- and post-training knowledge checks foreseen in the original evaluation design, adds items on value tensions and on whose interests are absent from committee work, extends the instrumentation towards Level 3 through a delayed follow-up item, records delivery phase by phase and introduces a documented route for adapting the didactic design.

Funding

This research received no external funding.

Participant Information and Voluntary Participation

Participation in the evaluation was voluntary. The consent statement shown to participants and the anonymity of the export are documented in Section 3.4; completion of the questionnaire followed that statement.

Data/Software Access Statement

Feedback data were collected anonymously online; no name or e-mail address was recorded. Item-level distributions are reported in full in Section 4. The underlying export is not shared publicly because the cohort of seven, the submission counts of four and six and the submission dates reported in Section 3.3 together carry a risk of indirect identification.

Contributor Statement

Teodora-Luiza Bulc: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – Original Draft, Review & Editing.

Use of AI

During the preparation of this work, the author used Claude (Anthropic) in order to support translation and language editing. After using this tool, the author reviewed, edited, made the content her own, and validated the outcome as needed, and takes full responsibility for the content of the publication.

Acknowledgements

The author thanks Prof. Dr. Karl Grün (Austrian Standards International) for supervising the work and for reading earlier versions of the manuscript and commenting on them.

Conflict Of Interest (COI)

The author is employed by Austrian Standards International, which offers the training pathway evaluated in the article.

References

Alliger, G. M., & Janak, E. A. (1989). Kirkpatrick's levels of training criteria: Thirty years later. *Personnel Psychology, 42*(2), 331–342. https://doi.org/10.1111/j.1744-6570.1989.tb00661.x

Austrian Standards International. (2022). Geschäftsordnung von Austrian Standards International (Ausgabe 1. Juli 2022) [Rules of procedure of Austrian Standards International, edition of 1 July 2022]. https://www.austrian-standards.at/geschaeftsordnung

Austrian Standards International. (2026a). Tätigkeitsbericht 2025 (Stand 31. Dezember 2025) [Activity report 2025, as at 31 December 2025]. https://cdn.austrian-standards.at/asset/reb_dokumente/Ueber-uns/Ueber-AS/ASI/Austrian_Standards_International_T%C3%A4tigkeitsbericht_2025.pdf

Austrian Standards International. (2026b). *Normung Insight 2.0, module N2: Detailed curriculum, 20 June 2026* [Internal course document].

Austrian Standards International. (2026c). *Normung Insight 2.0, module N3: Detailed curriculum, 20 June 2026* [Internal course document].

Austrian Standards International. (2026d). *Normung Insight 2.0, module N2: Participant handout, version 3, 20 June 2026* [Internal course document].

Austrian Standards International. (2026e). *Normung Insight 2.0, module N2: Deepening handout, final version 3, 20 June 2026* [Internal course document].

Austrian Standards International. (2026f). *Standardization Professional, first pilot: Reminder to complete the feedback questionnaire, 20 July 2026* [Internal e-mail].

Austrian Standards International. (2026g). *Standardization Professional: Wie Standards unsere Welt gestalten (Teil I) und Rollen und Prozesse der Normung (Teil II)* [How standards shape our world (Part I) and Roles and processes of standardisation (Part II); course description].https://www.austrian-standards.at/en/shop/academy/standardization-professional-standardisierung-verstehen-und-aktiv-mitgestalten~p4775197

Austrian Standards International. (2026h). *Normung Insight 2.0, module N1: Course build and screenplay* [Internal course document].

Austrian Standards International. (2026i). *Normung Insight 2.0, module N1: Completion records* [Learning-platform export, Articulate].

Austrian Standards International. (2026j). *Normung Insight 2.0, module N2: Slides, version 9, 20 June 2026* [Internal course document].

Bates, R. (2004). A critical analysis of evaluation practice: The Kirkpatrick model and the principle of beneficence. *Evaluation and Program Planning, 27*(3), 341–347. https://doi.org/10.1016/j.evalprogplan.2004.04.011

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. In *2013 ASEE Annual Conference & Exposition Proceedings*. American Society for Engineering Education. https://doi.org/10.18260/1-2--22585

Blind, K., & Drechsler, S. (2020). Necessary competences of employees in the field of standardization. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 113–137). Springer. https://doi.org/10.1007/978-3-030-28715-3_8

Blind, K., & von Laer, M. (2022). Paving the path: Drivers of standardization participation at ISO. *The Journal of Technology Transfer, 47*(4), 1115–1134. https://doi.org/10.1007/s10961-021-09871-4

Bulc, T.-L. (2026). Normung Insight 2.0: A value-driven, micro-modular pathway for standardisation education. "Austrian Standards" practitioner experience in re-designing education on standardisation. In K. Jakobs,

B. Reiter, & E. Staudegger (Eds.), *Proceedings EURAS 2026: Values in standards* (pp. 35–40). Wissenschaftsverlag Mainz.

Bundesministerium für Arbeit und Wirtschaft. (2024). Österreichische Normungsstrategie 2024 [Austrian standardisation strategy 2024]. https://www.bmwet.gv.at/Themen/Technik-und-Vermessung/Normung/%C3%96sterreichische-Normungsstrategie.html

Catalani Gabriel, L., de Vries, H. J., & Cleeland, B. (2022). Stimulating education about standardization: Activities and perspectives of national standards bodies. *Journal of Standardisation, 1*. https://doi.org/10.18757/jos.2022.6298

CEN-CENELEC. (2025). *Guideline for harmonized training on standardization for higher education within the European Union: Workshop description form (Parts A and B)*. https://www.cencenelec.eu/news-events/news/2025/workshop/2025-11-17-edu4standards/

CEN-CENELEC. (2026a). Guideline for education and training on standards and standardisation (CWA 18456:2026). European Committee for Standardization.

CEN-CENELEC. (2026b). *Internal Regulations Part 2: Common rules for standardization work* (January 2026 edition). https://boss.cen.eu/media/BOSS%20CEN/ref/ir2_e.pdf

Choi, D. G., & de Vries, H. J. (2011). Standardization as emerging content in technology education at all levels of education. *International Journal of Technology and Design Education, 21*(1), 111–135. https://doi.org/10.1007/s10798-009-9110-z

de Vries, H. J. (2020a). Addressing sustainability in education about standardisation: Lessons from the Rotterdam School of Management, Erasmus University. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 57–76). Springer. https://doi.org/10.1007/978-3-030-28715-3_5

de Vries, H. J. (2020b). Sustainable development: Knowledge and education about standardisation: Discussion. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 211–214). Springer. https://doi.org/10.1007/978-3-030-28715-3_13

de Vries, H. J., Trietsch, J., & Wiegmann, P. M. (2020). Learning in communities of standardisation professionals. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 179–190). Springer. https://doi.org/10.1007/978-3-030-28715-3_11

del Álamo, J., & Parada, H. (2025). *D3.1: Pilot design report* (Version 2, approved) [Project deliverable]. EDU4Standards.eu. https://doi.org/10.5281/zenodo.17721120

European Commission. (n.d.). High-Level Forum on European Standardisation. Retrieved 29 October 2026, from https://single-market-economy.ec.europa.eu/single-market/goods/european-standards/standardisation-policy/high-level-forum-european-standardisation_en

European Commission. (2022). *An EU strategy on standardisation: Setting global standards in support of a resilient, green and digital EU single market* (COM/2022/31 final). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52022DC0031

Fomin, V. V. (2020). From boring to intriguing: Personal perspective on making education about standardization appealing to students. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 31–43). Springer. https://doi.org/10.1007/978-3-030-28715-3_3

ISO/IEC. (2021). ISO/IEC Directives, Part 2: Principles and rules for the structure and drafting of ISO and IEC documents (9th ed.). International Organization for Standardization; International Electrotechnical Commission. https://www.iso.org/sites/directives/current/part2/index.xhtml

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education, 7*(2), 95–105. https://doi.org/10.1016/j.iheduc.2004.02.001

Graham, C. R. (2006). Blended learning systems: Definition, current trends, and future directions. In C. J. Bonk & C. R. Graham (Eds.), *The handbook of blended learning: Global perspectives, local designs* (pp. 3–21). Pfeiffer.

Grün, K. (2015). Wege, um Normen und Standards mitzugestalten [Ways to help shape standards]. *Zeitschrift für Recht des Bauwesens, 2015*(1), I–IV. https://doi.org/10.33196/zrb201501I01

Heß, P., Buggenhagen, M., & Blind, K. (2025). The impact of standard-setting knowledge networks on firm innovation. *Journal of Business Research, 200*, 115626. https://doi.org/10.1016/j.jbusres.2025.115626

Holton, E. F., III. (1996). The flawed four-level evaluation model. *Human Resource Development Quarterly, 7*(1), 5–21. https://doi.org/10.1002/hrdq.3920070103

Idowu, S. O., de Vries, H. J., Mijatovic, I., & Choi, D. (Eds.). (2020). *Sustainable development: Knowledge and education about standardisation*. Springer. https://doi.org/10.1007/978-3-030-28715-3

Jakobs, K. (2020). Responsibility by design?! On the standardisation of "smart" systems. In J.-S. Gordon (Ed.), *Smart technologies and fundamental rights* (pp. 285–315). Brill.

Kirkpatrick, J. D., & Kirkpatrick, W. (2016). *Kirkpatrick's four levels of training evaluation*. ATD Press.

Menold, N. (2020). Rating-scale labeling in online surveys: An experimental comparison of verbal and numeric rating scales with respect to measurement quality and respondents' cognitive processes. *Sociological Methods & Research, 49*(1), 79–107. https://doi.org/10.1177/0049124117729694

Menold, N., & Bogner, K. (2016). Design of rating scales in questionnaires. GESIS Leibniz Institute for the Social Sciences. https://www.gesis.org/fileadmin/admin/Dateikatalog/pdf/guidelines/design_rating_scales_questionnaires_menold_bogner_2016.pdf

Mijatović, I. (2020). Teaching standardization to generation Z: Learning outcomes define teaching methods. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 191–208). Springer. https://doi.org/10.1007/978-3-030-28715-3_12

Mijatović, I. (2025). *D2.3: Innovative teaching concept on standardisation: Use guide for standardisation education* [Project deliverable]. EDU4Standards.eu. https://doi.org/10.5281/zenodo.14850705

Mosakas, K., Fomin, V. V., Veljanova, H., Reiter, B., Staudegger, E., Bierbauer, D., & Kuzmuk, O. (2025). Bringing values to standardisation: From policy concepts to a value-based framework for education about standardisation. *Ethics and Information Technology, 27*(3), Article 38. https://doi.org/10.1007/s10676-025-09833-6

Puiu, S. (2020). Strategies on education about standardization in Romania. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 95–110). Springer. https://doi.org/10.1007/978-3-030-28715-3_7

Regulation (EU) No 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation. (2012). *Official Journal of the European Union, L 316*, 12–33. https://eur-lex.europa.eu/eli/reg/2012/1025/oj

Regulation (EU) 2019/1020 of the European Parliament and of the Council of 20 June 2019 on market surveillance and compliance of products and amending Directive 2004/42/EC and Regulations (EC) No 765/2008 and (EU) No 305/2011. (2019). *Official Journal of the European Union, L 169*, 1–44. https://eur-lex.europa.eu/eli/reg/2019/1020/oj

Scoppetta, S. (2025, December 13). Das unsichtbare Sicherheitsnetz [The invisible safety net; article with interview]. Kurier, Standort Österreich, p. 6.

Treaty on European Union (consolidated version). (2012). *Official Journal of the European Union, C 326*, 13–45. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:12012M/TXT

University of Graz. (2026). Technical standards and law (Course no. 232.990, winter semester 2026/27) [Course record]. Institut für Rechtswissenschaftliche Grundlagen. https://online.uni-graz.at/kfu_online/ee/ui/ca2/app/desktop/#/slc.tm.cp/student/courses/1001373

Van den Bossche, P. (2020). A look behind the curtain: Standardization education for engineers from the electric vehicle standardization shopfloor. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 17–29). Springer. https://doi.org/10.1007/978-3-030-28715-3_2

Vasileva, E. (2020). Education about standardization in the context of sustainable development. In S. O. Idowu, H. J. de Vries, I. Mijatovic, & D. Choi (Eds.), *Sustainable development: Knowledge and education about standardisation* (pp. 79–94). Springer. https://doi.org/10.1007/978-3-030-28715-3_6

Veljanova, H. (2025). *D2.1: Intended learning outcomes (ILOs) for standardisation education* [Project deliverable]. EDU4Standards.eu. https://doi.org/10.5281/zenodo.17721151