Review paper
UDK 37.018.43:004.4
DOI 10.7251/BLCZR0125041B

FUTURE-PROOF TEACHING FOR ENGINEERS

Lidija Beko[1]

ABSTRACT

This paper proposes an inclusive framework for future-proof teaching in engineering education, integrating language development, creativity, and student empowerment. As engineering students prepare for global, multilingual, and interdisciplinary careers, the need to embed English language learning and flexible pedagogy into technical education has become essential. The model is structured around four guiding principles: Start with a smile, Start with a small bite, Start with power, and Start with art. Each principle reflects a key dimension of learner-centred instruction: emotional readiness, scaffolded input, autonomy, creative engagement, and critical reading and thinking, i.e. meaning-driven learning. Drawing on research in language acquisition and arts integration, the paper illustrates how educators can transform traditional lecture-based approaches into dynamic environments where students feel safe to experiment, collaborate, and take ownership of their growth. Content and language integrated learning (CLIL) strategies are blended with technology-based techniques to enhance both linguistic and technical competence. This model prepares engineering students not only to master disciplinary content but to communicate confidently, think creatively, and adapt to future professional challenges. The approach also redefines the educator's role as a designer of experiences that support the full development of learners, especially in linguistically diverse classrooms.

KEYWORDS: *engineering education, language learning, creativity, student empowerment, CLIL, inclusive pedagogy*

JEZIČKO INŽENJERSKO OBRAZOVANJE SPREMNO ZA BUDUĆNOST

SAŽETAK

Ponuđeni rad predlaže okvir za nastavu geoloških inženjera koja, integrišući razvoj jezika, kreativnost i tehničko osnaživanje studenata, ispunjava inkluzivne elemente potrebne za budućnost. S obzirom da se studenti inženjerstva pripremaju za globalne, višejezične i interdisciplinarne karijere, potreba da se učenja engleskog jezika i fleksibilne pedagogije implementira u tehničko obrazovanje postaje neophodan uslov učenja. Model je strukturiran oko četiri vodeća principa: Počnite sa osmehom, Počnite sa malim zalogajem, Počnite sa snagom i Počnite sa umetnošću. Svaki princip odražava ključnu dimenziju nastave usmerene na studenta: emocionalnu spremnost, postepeni unos, autonomiju, kreativno angažovanje i kritičko čitanje i razmišljanje, tj. učenje vođeno smislom. Oslanjajući se na istraživanja u oblasti usvajanja jezika i integracije umetnosti, rad ilustruje kako edukatori mogu transformisati tradicionalne pristupe zasnovane na predavanjima u dinamična okruženja u kojima se studenti osećaju bezbedno da

1 Redovni profesor, Rudarsko-geološki fakultet, Univerzitet u Beogradu, mail: lidija.beko@rgf.bg.ac.rs

eksperimentišu, sarađuju i preuzmu odgovornost za svoj razvoj. Strategije učenja integrisanog sadržaja i jezika (CLIL) kombinuju se sa tehnikama zasnovanim na tehnologiji kako bi se poboljšala i jezička i tehnička kompetencija. Ovaj model priprema studente inženjerstva ne samo da savladaju disciplinarni sadržaj, već i da komuniciraju samouvereno, kreativno razmišljaju i prilagođavaju se budućim profesionalnim izazovima. Ovaj pristup takođe redefiniše ulogu edukatora kao kreatora iskustava koja potstiču potpuni razvoj studenta, posebno u jezički raznovrsnim učionicama ili situacijama.

KLJUČNE REČI: *inženjersko obrazovanje, učenje jezika, kreativnost, osnaživanje studenata, CLIL, inkluzivna pedagogija*

INTRODUCTION

Engineering education in the 21st century demands more than technical excellence. To truly prepare students for the dynamic, global, and interdisciplinary world they will enter, educators must adopt teaching practices that foster adaptability, resilience, empathy, and communication. English language learning plays a central role in this mission—not only as a tool for international communication, but as a gateway to academic success, professional development, and personal growth. Yet many traditional engineering programs continue to rely on rigid, lecture-centered instruction that neither supports diverse learning styles nor encourages linguistic and creative development.

This paper introduces a holistic, human-centered model for future-proof teaching for engineers, grounded in five interrelated principles: *Start with a Smile*, *Start with a Small Bite*, *Start with Power*, *Start with Art*. These ideas are not isolated pedagogical tips but foundational shifts in mindset—toward teaching that nurture the whole student.

Start with a Smile sets the emotional tone for learning. A warm, encouraging environment reduces anxiety, builds trust, and opens the door to risk-taking and language experimentation—key ingredients for successful language acquisition (Krashen, 1982). Smiling communicates approachability and respect, reinforcing a classroom culture where students feel safe to speak, try, and even fail as part of the learning process.

Start with a Small Bite emphasizes the importance of manageable, scaffolded input—especially vital for students learning in a second language. When educators break down complex tasks into accessible steps and build gradually toward mastery, learners gain the confidence and clarity they need to engage fully. This is particularly effective for Content and Language Integrated Learning (CLIL), where integrating technical content with linguistic development requires intentional pacing and thoughtful design. CLIL (Content and Language Integrated Learning) is a contemporary method of language education that combines subject learning with language development. It takes a dual-focus approach, using both the first language (L1) and one or more additional languages to help learners achieve specific goals in both content understanding and language proficiency (Maljers *et al.*, 2007; Marsh *et al.*, 2009; Coyle *et al.*, 2010; Mehisto *et al.*, 2008; and Ruiz de Zarobe *et al.*, 2010).

CLIL as a modern-day approach of language learning is conceptualized is a dual-focused teaching and learning approach in which the L1 (first language) and an additional language or two are used for promoting both content mastery and language acquisition to pre-defined levels.

Start with Power shifts the classroom dynamic from teacher-centered control to learner empowerment. By giving students a voice in decision-making, promoting choice, and valu-

ing their perspectives, educators foster a sense of ownership and motivation. For English learners, this empowerment is especially crucial—it encourages them to see themselves not just as students, but as capable, autonomous communicators (Cummins, 2000).

Start with Art champions creativity and emotional expression as vital elements in both language and engineering education. Including music, storytelling, visual media, and personal expression not only reduces stress and enhances memory but also cultivates interpersonal connection and joy in learning (Eisner, 2002; Robinson, 2011). Creativity makes language learning richer, more personal, and more human.

Together, these principles create a roadmap for future-proof teaching—one that prepares engineering students not only to master content, but to connect, collaborate, innovate, and thrive in an uncertain world. When learning is emotionally supportive, cognitively accessible, empowering, and creative, students are more likely to take responsibility for their learning and become the adaptable, communicative professionals the world needs.

START WITH A SMILE

Human beings, much like other social species, are inherently communal; we organize ourselves into families, teams, associations, and networks to cultivate connection and cooperation. This deeply embedded social inclination is not merely an evolutionary trait—it is a critical component of how we teach and learn. In the context of language education and broader learning 6environments, affective dimensions play a pivotal role in shaping student engagement and achievement. Krashen's (1982) *Affective Filter Hypothesis* emphasizes that emotional variables—such as anxiety, motivation, self-confidence, and classroom atmosphere—can significantly influence a learner's capacity to absorb and process new language input. As he notes, "When the filter is up, it impedes language acquisition; when it is down, it facilitates it" (Krashen, 1982, p. 31). This insight underscores the importance of cultivating a classroom climate that is emotionally safe, socially inclusive, and intellectually inviting.

One of the simplest yet most powerful ways educators can begin this process is by smiling—long before the seasonal obligations of December—and by demonstrating authentic warmth and curiosity about their students as individuals. Establishing a sense of community begins with small acts: learning students' names quickly, using them frequently, and facilitating activities that allow students to learn each other's names as well. Such gestures are not merely pedagogical formalities; they are foundational to fostering what Palmer (1998) calls "relational trust"—the deep belief that the classroom is a place where each student is seen, valued, and respected. When students feel emotionally secure and socially connected, they are far more likely to take academic risks, engage collaboratively, and persist in the face of challenge (Zins et al., 2004). Instructors, particularly in higher education where classrooms can be large and impersonal, must be intentional about creating environments where affective barriers are minimized. A smile, then, is not just a courtesy—it is a pedagogical intervention with cognitive, emotional, and social implications. As hooks (1994) reminds us, "The classroom remains the most radical space of possibility in the academy," and it is through small, humanizing gestures that this possibility begins to take root.

START WITH A SMALL BITE

The phrase *"Start with a Small Bite"* underscores the significance of incremental learning—beginning with manageable portions of knowledge to ensure comprehensive understanding. In the realm of English language acquisition for geology engineering students, this approach is particularly pertinent. Engineering education aims to equip graduates with not only technical expertise but also a diverse skill set and a professional attitude. However, traditional "one-size-fits-all" lecture-centred methodologies often overlook individual learning preferences, potentially hindering student engagement and progress.

Recognizing and accommodating diverse learning styles is essential. For instance, integrating collaborative learning strategies can significantly enhance student engagement and understanding. Peer-Led Team Learning (PLTL), a model where students who have excelled in a course lead small groups in problem-solving sessions, has shown positive outcomes in various disciplines, including engineering. Studies indicate that PLTL can lead to improved student attitudes and performance by fostering a collaborative learning environment (Tien et al., 2002).

Furthermore, the incorporation of Information and Communication Technologies (ICT) into the learning process supports a more gradual and holistic development of students. Tools like Google Drive facilitate collaborative activities, allowing students to work together in real time and enhancing communication skills (Wichadee, 2017). Similarly, flipped classroom models, where students engage with content outside of class and apply knowledge during interactive sessions, have proven effective in promoting active learning and student engagement (Gilboy et al., 2015).

The strategic use of gamification and digital tools can further support student learning. Research has shown that gamified instruction increases student motivation and participation, creating a more engaging and effective learning environment (Koivisto & Hamari, 2019).

By adopting these pedagogical strategies—acknowledging diverse learning styles, fostering collaboration, integrating ICT, and utilizing gamification—educators can create a more inclusive and effective learning environment. This approach ensures that all students, regardless of their initial proficiency, can develop the necessary language skills and professional competencies to succeed in their engineering careers.

START WITH POWER

The concept of *"Start with Power"* highlights the vital role of autonomy and personal agency in education. While "power" can suggest dominance, in this context, it reflects the positive pursuit of self-improvement—developing the knowledge, skills, and confidence that enable individuals to lead purposeful lives, achieve meaningful goals, and enhance their self-worth. William Glasser (1998) identified power as a basic human need, one that, when fulfilled through learning, fosters intrinsic motivation and personal responsibility. Education that recognizes and nurtures this drive for mastery and self-determination can transform learners into active participants in their development.

Meeting the need for power means designing instruction that empowers students through relevance, voice, and competence. Engineering students often perceive language learning as disconnected from their technical fields, which can reduce motivation. To

counter this, instruction should integrate discipline-specific content—such as technical vocabulary, reading engineering case studies, and writing diverse reports—into the English curriculum (Basturkmen, 2010). This relevance gives students a sense of purpose and control over their learning, as they see immediate applications of language in their future careers.

Empowerment also involves giving students a voice in their learning. Encouraging feedback, involving them in co-creating behavioural norms, and incorporating their professional interests into classroom activities boosts engagement (Cook-Sather, 2006). Teaching should be differentiated to accommodate diverse learning preferences using brain-based strategies (Jensen, 2008), structured cooperative learning (Johnson, Johnson & Smith, 2014), and multimodal materials (videos, simulations, technical podcasts). These approaches help all students—including those less confident in English—develop linguistic competence in a supportive, low-anxiety environment.

Assessment plays a critical role in this empowerment process. Traditional one-shot testing can discourage learners who are still developing both content and language skills. Instead, authentic assessment—such as project-based presentations, collaborative problem-solving tasks, and portfolios—offers meaningful ways to demonstrate learning (Brown, 2004). Allowing students multiple opportunities to revise and improve their work, rather than assigning failing grades, cultivates a growth mindset (Dweck, 2006) and reinforces the idea that persistence and effort lead to success.

Regarding CLIL and teaching English to engineers should not be about control, correction, and conformity. It should be about enabling future professionals to communicate confidently in global contexts, work effectively in multilingual teams, and present their ideas with clarity and conviction. Meeting their intrinsic need for power means helping them take charge of their own learning—and their future.

Reading plays a fundamental role in learning and developing critical thinking skills. However, in our fast-moving digital era, many students have moved away from the habit of reading deeply and thoughtfully. The growing preference for quick, surface-level content—like social media updates and short videos—can greatly impact students' ability to engage with complex concepts and think critically.

Critical reading involves more than just understanding the text. When students engage in this kind of reading, they are actively interacting with ideas, not passively absorbing information. Additionally, when reading is motivated by curiosity and self-growth, students are more likely to engage deeply with the material. This type of reading often leads to new perspectives and intellectual development. Rather than reading simply to pass an exam or complete a required assignment, students who read out of genuine curiosity are more likely to encounter a diversity of ideas, which can challenge their preconceptions and simulate more sophisticated thinking. Encouraging students to read outside the prescribed syllabus is a great way to foster curiosity. Books, articles, and essays on various topics – from philosophy to history to science – can help them expand their worldview, stimulate their imagination, and nurture independent thought. Ultimately, the best way to inspire a lifelong love of reading is to connect it to the pleasure of discovery. When students realize that reading isn't just a means to an academic end, but a way to discover new ideas, perspectives, and solutions to problems, they will be more likely to read critically on their own.

This passion for reading can translate into a more thoughtful, reflective, and intellectually curious approach to life.

When it comes to acquiring academic English, research suggests that learners typically need between four and seven years in an English-speaking environment to reach a level of proficiency suitable for academic success (Hakuta et al., 2000; Cummins, 2000). In the face of having to teach complex academic content to students who are still developing their English skills, teachers may be tempted to simplify tasks or reduce their cognitive demands. However, Cummins (2007) cautions that this well-intentioned approach can unintentionally limit students' opportunities for both language and content learning. If tasks are made too simple, learners may remain in a limited educational environment that does not challenge them enough to promote real progress. To address this, high-quality instructional materials that highlight the structure and use of academic language can serve as valuable scaffolding. Such resources not only support students but also assist subject teachers—who may not always feel equipped to address the linguistic demands of their discipline, making the academic language of their field more accessible.

START WITH ART

Start with Art champions' creativity not as an optional enrichment but as a vital component of future-proof education, especially in engineering contexts where innovation and complex problem-solving are core professional demands. Creativity reduces stress, fosters emotional resilience, and enhances relational learning. As Eisner (2002) argues, "the arts provide the kinds of experiences that require imagination, exploration, and expression—skills essential in all fields, including science and engineering." When educators incorporate artistic elements such as music, visual media, storytelling, or digital creation, they not only enrich the learning experience but also model creative risk-taking. Teachers cannot authentically encourage creativity unless they too embark on this adventure—crafting dynamic, responsive lessons that value aesthetics, curiosity, and experimentation (Robinson, 2011).

Incorporating artistic expression—through sketching geological forms, composing reflective journals, or analyzing the aesthetics of natural structures—makes learning more personal and memorable. The integration of artistic modalities into STEM has been supported by the STEAM movement (Science, Technology, Engineering, Arts, Mathematics), which shows that such fusion enhances student engagement and cognitive flexibility (Yakman & Lee, 2012). Furthermore, creativity supports the development of social-emotional competencies. Collaborative art-based tasks build relationships, while emotionally expressive assignments increase empathy and self-regulation (Winner, Goldstein, & Vincent-Lancrin, 2013).

In engineering education, where pressure and abstraction can hinder expressive learning, art opens space for students to be brave, make meaning, and connect more deeply to their studies. When students experience learning environments where risk-taking and emotional expression are welcomed, they are more likely to behave responsibly and engage authentically. *Start with Art* thus becomes a strategy to unlock the human potential in our future engineers—to nurture learners who not only master knowledge but who also care, imagine, and lead.

Integrating creative activities into English language teaching for geology students supports not only language development but also essential cognitive and professional growth. Encouraging learners to think creatively fosters the kind of flexible and open-minded engagement that is crucial for both scientific inquiry and personal development. Creative thinking involves generating multiple possibilities, exploring alternative interpretations, and sharing diverse viewpoint skills that align closely with the problem-solving nature of geological work.

One effective way to promote such thinking is through the Visible Thinking approach, a method developed by Project Zero at Harvard. This research-based framework emphasizes making students' thought processes explicit as they engage with subject matter. It is grounded in the belief that learning stems from thinking, that thinking is inseparable from content, and that it does not unfold in a strictly linear fashion (Ritchhart et al., 2011).

In the context of engineering education, Visible Thinking serves a dual purpose: it enhances understanding of complex concepts (such as geological processes or scientific vocabulary in English) and nurtures critical and creative thinking habits. These include curiosity, interpretation, thoughtful questioning, reasoning with evidence, forming conclusions, and metacognition—all of which are valuable in scientific discourse and international communication.

Incorporating visual, both artistic and scientific prompts in English classes can activate diverse dispositions and deepen students' engagement with both language and art content. By making thinking visible, future geologists are better equipped not only to articulate their knowledge in English but also to approach their field with a more inquisitive and innovative mindset.

CONCLUSION

As we look ahead to an increasingly complex, interconnected, and rapidly changing world, the role of engineering education must evolve accordingly. Technical skills alone is no longer sufficient. The engineers of tomorrow must be communicative, creative, and collaborative, capable of navigating diverse cultures, uncertain futures, and multidisciplinary challenges. The model proposed in this paper—anchored in the principles *Start with a Smile, Start with a Small Bite, Start with Power, Start with Art*—offers a human-centered framework for building such capacities in students.

These principles are not just strategies; they are philosophical commitments. They call on educators to design emotionally supportive, cognitively accessible, empowering, and expressive learning environments. *Start with a Smile* reminds us that affective safety is a prerequisite for risk-taking and growth. *Start with a Small Bite* reinforces the power of clarity, scaffolding, and personalization in enabling learning across linguistic and cognitive divides. *Start with Power* centers student agency, engagement, and meaningful connection between language learning and professional identity. *Start with Art* reclaims imagination and emotional expression as central to technical education, deepening both understanding and motivation.

By embracing this holistic approach, educators empower future engineers to be more than competent technicians—they become thoughtful communicators, adaptive learners, and empathetic global citizens. This transformation does not require abandoning rigor;

rather, it demands reimagining rigor as something that also includes joy, humanity, and imagination. The classroom, as bell hooks reminds us, is a space of radical possibility. Future-proofing engineering education begins with the courage to humanize it.

REFERENCES

- Basturkmen, H. (2010). *Developing courses in English for specific purposes*. Palgrave Macmillan.
- Brown, H. D. (2004). *Language assessment: Principles and classroom practices*. Pearson Education.
- Cook-Sather, A. (2006). Sound, presence, and power: "Student voice" in educational research and reform. *Curriculum Inquiry*, 36(4), 359–390. https://doi.org/10.1111/j.1467-873X.2006.00363.x
- Cummins, J. (2000). *Language, power and pedagogy: Bilingual children in the crossfire*. Multilingual Matters.
- Cummins, J. (2007) Language Interactions in the Classroom: From Coercive to Collaborative Relations of Power. In O. García, C. Baker (eds.) Bilingual Education: An Introductory Reader. Clevedon: Multilingual Matters.
- Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House.
- Eisner, E. W. (2002). *The arts and the creation of mind*. Yale University Press.
- Gilboy, M. B., Heinerichs, S., & Pazzaglia, G. (2015). Enhancing student engagement using the flipped classroom. *Journal of Nutrition Education and Behavior*, 47(1), 109–114. https://doi.org/10.1016/j.jneb.2014.08.008
- Glasser, W. (1998). *Choice theory: A new psychology of personal freedom*. HarperCollins.
- Hakuta, K., Butler, Y.G., Witt, D. (2000) How Long Does It Take English Learners to Attain Proficiency? Policy Report 2000-1. Stanford: The University of California Linguistic Minority Research Institute.
- hooks, b. (1994). *Teaching to transgress: Education as the practice of freedom*. Routledge.
- Jensen, E. (2008). *Brain-based learning: The new paradigm of teaching* (2nd ed.). Corwin Press.
- Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Cooperative learning: Improving university instruction by basing practice on validated theory. *Journal on Excellence in College Teaching*, 25(4), 85–118.
- Koivisto, J., & Hamari, J. (2019). The rise of motivational information systems: A review of gamification research. *International Journal of Information Management*, 45, 191–210. https://doi.org/10.1016/j.ijinfomgt.2018.10.013
- Krashen, S. D. (1982). *Principles and practice in second language acquisition*. Pergamon Press.
- Maljers, A., Marsh, D., Wolff, D. (eds) (2007) Windows on CLIL. Content and Language Integrated Learning in the Spotlight. The Hague: European Platform for Dutch Education.
- Marsh, D., Mehisto, P., Wolff, D., Aliaga, R., Asikainen, T., Frigols-Martín, M.J., Hughes, S., Langé, G. (eds) (2009) CLIL Practice: Perspectives from the Field. Rovaniemi/Jyväskylä: CLIL Cascade Network/University of Jyväskylä.
- Mehisto, P., Marsh, D., Frigols, M.J. (2008) Uncovering CLIL: Content and Language Integrated Learning in Bilingual and Multilingual Education. Oxford: Macmillan.
- Nation, I. S. P., & Macalister, J. (2010). *Language curriculum design*. Routledge.
- Palmer, P. J. (1998). *The courage to teach: Exploring the inner landscape of a teacher's life*. Jossey-Bass.
- Ritchhart, R, Church, M and Morrison, K (2011) *Making Thinking Visible: How to Promote Engagement,Understanding, and Independence for All Learners.* San Francisco: Jossey-Bass.
- Robinson, K. (2011). *Out of our minds: Learning to be creative* (2nd ed.). Capstone
- Ruiz de Zarobe, Y., Manuel Sierra, J., Gallardo del Puerto, F. (eds) (2010) Content And Foreign Language Integrated Learning: Contributions To Multilingualism In European Contexts. Frankfurt am Main: Peter Lang.

- Tien, L. T., Roth, V., & Kampmeier, J. A. (2002). Implementation of a peer-led team learning instructional approach in an undergraduate organic chemistry course. *Journal of Research in Science Teaching*, 39(7), 606–632. https://doi.org/10.1002/tea.10038
- Wichadee, S. (2017). Collaborative learning through cloud-based tools in a translation course. *Teaching English with Technology*, 17(2), 38–56. http://www.tewtjournal.org
- Winner, E., Goldstein, T. R., & Vincent-Lancrin, S. (2013). *Art for art's sake? The impact of arts education*. OECD Publishing. https://doi.org/10.1787/9789264180789-en
- Yakman, G., & Lee, H. (2012). Exploring the exemplary STEAM education in the U.S. as a practical educational framework for Korea. *Journal of the Korean Association for Science Education*, 32(6), 1072–1086. https://doi.org/10.14697/jkase.2012.32.6.1072
- Zins, J. E., Weissberg, R. P., Wang, M. C., & Walberg, H. J. (Eds.). (2004). *Building academic success on social and emotional learning: What does the research say?* Teachers College Press.