Integrating Skills Into the Learning Outcomes of an Educational Process

From Theory to Practice

June 2025

AFEKA
The Academic College of Engineering in Tel Aviv

Developing skills

is crucial for career success,
for thriving in modern society,
and for enhancing lifelong learning

Foreword

In May 2021, Afeka — The Academic College of Engineering in Tel Aviv released the Afeka Framework: Implementing Change in an Educational Process Using the Principles of Engineering Design. This framework describes not only the results of our approach, but more importantly, the practical methodology and process that yielded these results. The framework began with a fundamental principle of engineering design: Any transformative change must start by clearly defining its desired outcome—in our case, the ultimate Afeka engineering graduate profile.

Our transformative journey began by asking ourselves some challenging but crucial questions: Do we truly understand the graduate profile that industry employers are seeking? Does our current educational process effectively lead to this desired outcome? These questions prompted an intensive year-long collaborative process with key internal and external stakeholders to formulate a consensus on the Afeka engineering graduate profile.

While our existing learning outcomes emphasized scientific and professional knowledge, we expanded our definition to encompass essential competencies (knowledge, skills, and values) required of engineers in today's evolving job market. We organized these into five categories that are reflected in our graduate profile: engineering skills, personal skills, languages, values, and general knowledge.

With the graduate profile as our compass, we aligned all aspects of our engineering education process toward a common goal: developing learning outcomes that directly reflect the essential attributes of our ideal graduate. We accomplished this by establishing change-generating platforms and integrating supporting activities across all operational channels in the college. We updated curricula, courses, and learning outcomes; adapted teaching methodologies; created extensive activities outside the formal curriculum; transformed campus teaching, learning, and experiential spaces; upgraded organizational infrastructure; and cultivated a supportive organizational culture. Throughout this process, we continuously engaged in collective learning and reflection, enabling us to improve our approach during this multi-year transformation.

In the Afeka Framework document, we chose to focus on the process itself—its components, stages, and the insights gained, rather than on specific outcomes of the process. We believe that focusing on skills development without a comprehensive view of the educational process would yield only partial results that might ultimately fail to create meaningful change and could even undermine knowledge acquisition.

The process of writing the framework itself allowed us to break down our experience into organized work stages and generate additional insights. In retrospect, we learned that collaborative partnerships are essential—both internally and through building ecosystems with external stakeholders. We discovered the importance of internal communication, organizational initiatives, and community-building, and recognized that this is a long-term process of continuous collaborative learning.

While Afeka's primary focus is on STEM education, the practical methodology we've developed has universal applications across various educational systems and professional fields. Now, in response to significant interest in our curricular changes and requests for more detailed implementation guidance, we have created this comprehensive document describing how to gradually integrate skills as learning outcomes of any educational process.

If you are exploring how to integrate skills development within your educational process—from initiating the process through defining skills, integrating them as learning outcomes, or adapting pedagogy, and assessment methods—this document will provide valuable practical guidance based on our real-world experience.

Prof. Ami Moyal
President

Introduction

Accelerating technological changes are reshaping our world and affecting all aspects of life. These transformations highlight the growing need to develop skilled human capital while emphasizing the critical importance of STEM education across the entire educational continuum—from kindergarten through higher education.

The discourse surrounding competency development broadly, and skills acquisition specifically, has permeated various sectors in recent years, including formal and informal educational systems, academia, military organizations, and the job market. These stakeholders recognize that the dramatic changes of the past decade, intensified by the COVID-19 pandemic, necessitate fundamental transformations in teaching and learning methodologies. These changes must directly address developments in technology, science, economics, sustainability, and globalization to prepare us—as nations, as systems, as organizations, and as individuals—for the emerging reality we now face.

This rapidly evolving technological landscape requires not just knowledge acquisition, but the development of specific skills that enable adaptability and continuous learning. This reality makes defining the "graduate profile"—a comprehensive description of the knowledge, skills, and values that students should possess upon completing their education—a crucial first step in educational transformation.

Defining a graduate profile and transforming an educational process accordingly is a complex, long-term endeavor that requires significant resources and imposes additional responsibilities on the entire educational team. This process must be implemented gradually and systematically. Initial resistance is common, with partners and supporters typically joining as success becomes evident. Therefore, involving all stakeholders from the earliest planning stages is crucial, as is establishing open communication channels to effectively share progress throughout the implementation process.

The Afeka Framework, originally published in 2021, offers a comprehensive methodology for implementing change in STEM education across the educational continuum, based on defining the graduate profile as the goal. The framework describes not only the outcome, but the process that led to it—a methodology rooted in the engineering design principles: ask, imagine, plan, create, experiment, and improve. This approach guided our incorporation of skills into the graduate profile as part of learning outcomes that reflect changing societal and workplace needs.

At Afeka College, we applied this methodology to transform our engineering education program into a fully competency-based process that systematically develops the attributes needed by today's engineers. With our clearly defined graduate profile as our compass, we established platforms to drive change across all aspects of our educational process. Throughout this long-term transformation, we've continuously engaged in organizational learning and assessment to refine our approach.

In this document, we share our process design, implementation stages, and key insights as a systematic "algorithm" to help other educational institutions integrate skills development into their own educational outcomes. We believe our experience can serve as a foundation for broader educational initiatives seeking to prepare students for success in our rapidly changing world.

Integrating Skills Development into an Educational Process

The Core Stages of the Model

This chapter outlines a comprehensive approach to integrating skills development into the educational process. It provides a step-by-step guide for formulating the graduate profile, defining vital skills, establishing proficiency progression frameworks, and creating specific learning outcomes for each skill. The chapter then explores how these outcomes are integrated into program syllabi to create a multi-year educational continuum for coherent skills development. Additionally, it covers approaches to adapting pedagogy to effectively impart these skills, ensuring that teaching methods directly align with skill acquisition goals.

Figure 1 below provides a visual roadmap of the entire process, illustrating how each stage builds upon the previous one to create a comprehensive skills development framework. The diagram details the targets, objectives, and expected outcomes (milestones) at each point in the process, offering a clear overview of the journey from initial goal-setting to full implementation.

Figure 1: A schematic overview of the Afeka model for cultivating skills

Target	Objective	Milestone
Identifying the goal	Determining your focus—knowledge, skills, and values	A decision to define a graduate profile (knowledge, skills, and values)
Skills—selection, definition, and assessment metrics	Selecting the skills to be imparted throughout the educational process	The list of skills to be incorporated into the graduate profile, or a complete definition of the graduate profile (encompassing knowledge, skills, and values), collectively agreed upon by all relevant stakeholders
	Defining the selected skills	A comprehensive document listing all skills within the graduate profile, each accompanied by stakeholder-approved definitions
	Establishing skill proficiency levels and assessment metrics	A multi-tiered competency scale for each skill, with distinct, measurable assessment criteria per level
Identifying skills development gaps in the existing educational process	Mapping existing skills development across the curriculum	A mapping of the skill competency level imparted in each course within the existing educational process
	Pinpointing the gaps between the existing and the desired skills development process	A mapping of the gaps between the proficiency level of skills imparted at each stage of the existing educational process (the result of mapping the current state) and the desired competency scale
Revising the educational process to enhance skills acquisition	Aligning course learning outcomes with the multi-tiered proficiency scale to create a progressive skills development curriculum	Revised syllabi with course-specific learning outcomes aligned to target skill competencies, reflecting the updated curriculum design
	Making resources accessible and establishing management infrastructure	A readily available resource base that presents the desired outcome at various stages of the educational process and any necessary implementation tools
Managing the implementation of change in the educational process	Developing pedagogical strategies that support attaining the desired learning outcomes	Course-aligned pedagogical approaches supporting expected skill acquisition learning outcome
Formulating an assessment model	Creating an assessment model for an individual course, an academic year, or the entire educational process	Continuous skill assessment model integrating defined metrics throughout the entire educational journey

Identifying the Goal

1. Determining your focus—knowledge, skills, and values

The main question at the outset is: What should we focus on?

Consider whether you need to address all aspects of the graduate profile (knowledge, skills, and values) at once, or if you can build on existing strengths while developing new areas.

This practical approach helps you adapt the process to your institution's unique situation and available resources.

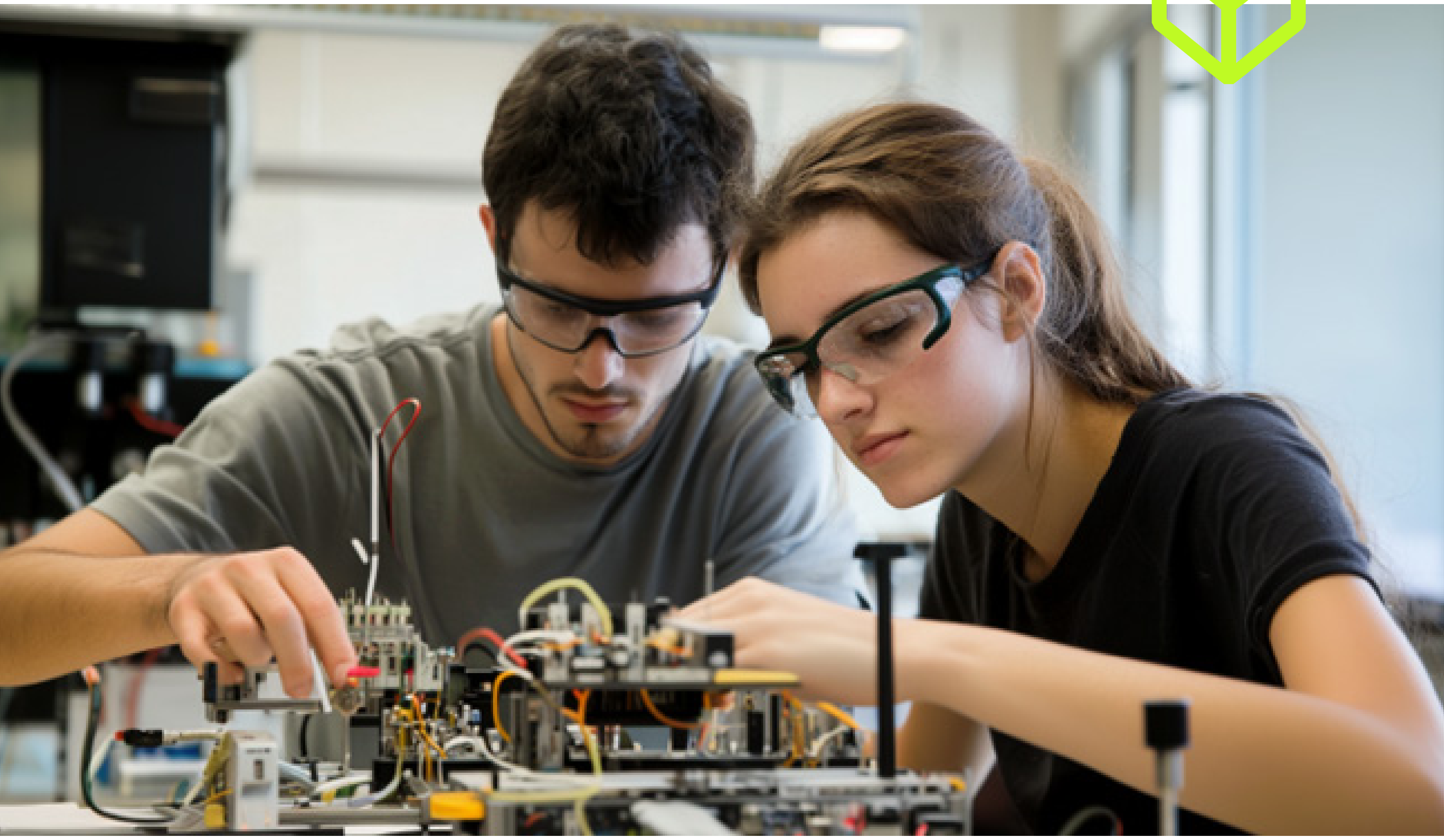
Most educational systems already have well-defined learning outcomes for knowledge. Review these existing frameworks—they may be sufficient or require only modest updates. At the same time, check if you have any foundations for skill and value development that you can expand upon rather than creating everything from scratch.

Your graduate profile should reflect your institution's unique culture and environment. Remember that each component of this profile contains both universal elements that cross disciplines and specialized elements specific to particular fields of study.

Take time with this initial step that is meant to focus your goals. Even when concentrating on just one aspect of the graduate profile, the entire process requires significant time and resources. A clear, well-defined focus creates a precise target for your desired outcomes and helps engage all stakeholders as the project progresses. The decisions you make now will shape your entire implementation journey, so thoughtful consideration at this stage will benefit every

Milestone

The decision to define a graduate profile (knowledge, skills, and values)



Skills—Selection, Definition and Assessment Metrics

2. Selecting the skills to be imparted throughout the educational process

Over the past decade, skills development has become a central concern for educational systems, academic institutions, and employers worldwide. Numerous studies have documented essential competencies, with most converging on a core set of skills that apply across different contexts.

Exploring existing skill frameworks can save you considerable effort. Review recognized taxonomies to understand how they might apply to your specific educational goals. Even frameworks developed for specialized fields like STEM often identify universal skills that transfer well to other domains. These established models provide an excellent foundation for determining which skills will best serve your students.

When selecting skills for your graduate profile, you are essentially defining the outcomes of your entire educational process. This requires input from all key stakeholders—leadership, faculty, students, and representatives from institutions or employers who will receive your graduates.

This inclusive approach ensures your selected skills truly reflect your desired graduate outcomes, and that the number of skills remains realistic and achievable within your institutional context. It also creates shared ownership of the outcome, which will prove invaluable during implementation. When stakeholders participate in identifying which skills are essential, they develop a deeper understanding of why these skills matter and how they contribute to the graduate profile, making them more likely to support the changes needed to develop these skills in students.

While this document focuses primarily on skills development, remember that if you're creating a comprehensive graduate profile, your work at this stage should address knowledge and values alongside skills. All three components work together to create a complete picture of your ideal graduate.

Milestone

The list of skills to be incorporated into the graduate profile, or a complete definition of the graduate profile (encompassing knowledge, skills, and values), collectively agreed upon by all relevant stakeholders

3. Defining the selected skills

After finalizing your skill list, establish clear, shared definitions that everyone understands and supports. While it's tempting to adopt ready-made definitions from existing reports, these should be carefully examined for relevance to your specific context—just as you did with the skill list itself.

The definition process should be collaborative. When stakeholders discuss and refine these definitions together, it sparks valuable dialogue throughout your organization and with external partners. This shared understanding makes implementation smoother because everyone grasps what each skill means in your specific setting, increasing their commitment to the change process.

To begin, have change leaders introduce the topic to key stakeholders (such as teaching committees and faculty members in academic settings). Ask these stakeholders to reflect on each skill's core meaning and how its definition should align with your graduate profile. Use existing definitions as starting points, but adapt them to fit your institution's unique context.

This stage is crucial for engaging your educational team with both the process and the definitions. When people question assumptions, discuss alternatives, and even debate specific points rather than automatically accepting pre-existing definitions, each participant contributes their perspective. This collaborative approach enriches both the process and the final product.

Milestone

A comprehensive document listing all skills within the graduate profile, each accompanied by stakeholder-approved definitions

4. Establishing skill proficiency levels and assessment metrics

Skill development is a continuous journey, not a single event or disconnected series of activities. Each learning experience contributes to a student's growing mastery in a progressive, cumulative way. This developmental process interacts with other educational activities, creating a complex web of learning that shapes the student's overall growth.

When defining skills, create a multi-tiered competency scale that shows clear progression toward mastery. Map out distinct proficiency levels with specific assessment criteria for each skill. This approach helps educators design sequential learning experiences that build systematically upon each other, creating a coherent developmental pathway rather than isolated skill-building activities. Such structured progression allows for more precise evaluation of learning outcomes that accurately reflect each student's developmental journey.

These clearly defined proficiency levels guide everyone involved in the educational process. Administrators use them for curriculum planning and quality assurance. Teaching staff develop appropriate teaching methods for each skill level and understand how skills should advance through courses and across the program. Students gain transparency about what's expected at each stage of their education. The framework also provides a consistent approach for assessing achievement at each level, making it possible to track and evaluate progress effectively over time.

Remember that skills may naturally develop along different trajectories—some requiring more stages than others. There is no "correct" number of proficiency levels, and different skills may need different numbers of developmental stages. Forcing all skills into the same number of levels might create artificial distinctions or obscure meaningful differences. For this reason, we offer no specific target or recommendation about how many levels to use, giving you flexibility to determine the most appropriate progression framework for each skill.

Milestone
A multi-tiered competency scale for each skill,
with distinct, measurable assessment criteria per level

Identifying Skills Development Gaps in the Existing Educational Process

5. Mapping existing skills development across the curriculum

Skills are likely already being developed throughout your educational programs, even if not in a structured or explicit way. Once you've selected and defined your target skills, examine your current educational process to discover which skills are already being cultivated, at what levels, and in which courses.

Share your skill definitions with teaching staff who deliver educational content daily. These instructors have firsthand knowledge of how skills are currently being developed within their courses. Ask them to review existing syllabi, learning outcomes, and teaching approaches to identify where skill development is already happening organically.

Create a systematic mapping of skill acquisition across all relevant courses and educational activities based on your established competency levels. This comprehensive approach helps recognize existing contributions to skill development, identify gaps, and prevent inconsistencies.

Make sure to clearly distinguish between skills that are relevant to a course but not yet explicitly included in the syllabus versus skills that aren't relevant to that course at all. Encourage faculty to identify when particular skills don't naturally fit their courses. This distinction ensures accurate gap identification and prevents forcing skill development where it doesn't belong.

This mapping process typically sparks valuable discussions about how different educators interpret skill definitions and proficiency levels. These conversations help create a shared understanding across your institution. The dialogue often generates insights that may lead to refining your initial definitions, making them more practical across diverse courses. Designate a coordinator to oversee this process, harmonize definitions, and facilitate the development of a common language throughout your organization.

Milestone
A comprehensive mapping that shows which skills are currently being developed in each course and at what competency level, providing a clear baseline of your existing educational process

6. Pinpointing the gaps between the existing and the desired skills development process

When you compare your current state mapping with your desired outcomes, you create a clear picture of existing gaps. This analysis reveals where you need changes to build stronger connections between courses and create a more cohesive educational experience. By examining each skill systematically, you can identify exactly where current practices differ from your goals.

Approach this analysis with an open mind—avoid both assuming your existing courses already develop skills adequately or assuming everything needs complete redesign. This balanced perspective allows for objective assessment and helps you direct resources where they'll have the greatest impact.

Consider learning outcomes at multiple levels: individual courses, academic years, and the complete educational journey. This layered view ensures skills develop gradually and coherently throughout the educational process. The gap analysis serves a dual purpose: it identifies areas needing improvement while also highlighting effective existing practices that might otherwise remain hidden. These successful initiatives can often be adapted and expanded to benefit other courses, enhancing your overall educational program.

Share your findings systematically across your organization. This transparency helps everyone understand both the unique contribution of each course and how courses work together toward shared educational goals. With this comprehensive understanding, you can design a truly progressive learning experience.

Milestone

A mapping of the gaps between the proficiency level of skills imparted at each stage of the existing educational process (the result of mapping the current state) and the desired competency scale

Revising the Educational Process to Enhance Skills Acquisition

7. Aligning course learning outcomes with the multi-tiered proficiency scale to create a progressive skills development curriculum

After identifying gaps between current and desired states, your education team should collaborate to revise course learning outcomes. These revisions should align with the required competency level for each skill at every stage of the learner's journey, creating an organized, coordinated progression throughout the educational process.

Incorporate the defined learning outcomes for each skill level into course syllabi across your curriculum. While you can build upon existing effective practices, you may also need to share knowledge and develop new teaching approaches. The goal is to create an educational journey that develops all skills to their advanced levels by the time students graduate.

As faculty implement these changes, they'll likely gain practical insights that could improve your original definitions. View your competency scale as a living document that can evolve based on real-world experience rather than as a rigid framework.

Expect and welcome varying interpretations of your established definitions, especially if multiple programs share a common graduate profile. Encourage ongoing dialogue to refine and clarify these definitions based on faculty experience.

Make changes that are relevant to course content and are appropriately timed within the learning process. Distribute changes evenly to avoid overwhelming students and faculty. Remember that not every course should develop all skills—focus on two or three skills per course to maintain the integrity of knowledge-based learning outcomes. Skills should be reinforced at various points throughout the curriculum, allowing for deeper internalization at each level. These skills complement rather than replace core knowledge content, which remains the foundation of the educational process.

Milestone

Revised syllabi with course-specific learning outcomes aligned to target skill competencies, reflecting the updated curriculum design

8. Making resources accessible and establishing management infrastructure

After you have defined skills, created competency scales, and mapped skill development across your curriculum, build a comprehensive resource center that organizes all this information in one place. This centralized system gives educators and stakeholders easy access to everything they need.

Such a resource provides a clear, real-time overview of expectations at every level—from individual students to classrooms, courses, programs, and your entire institution. It creates transparency about what should be happening at each stage of the educational process and serves as the foundation for future evaluation efforts.

Milestone

A readily available resource base that presents the desired outcome at various stages of the educational process and any necessary implementation tools

Managing the Implementation of Change in the Educational Process

9. Developing pedagogical strategies that support attaining the desired learning outcomes

Once you have defined learning outcomes for your entire educational program, academic years, and individual courses, you can begin adapting your teaching approaches. This involves developing pedagogical methods specifically designed to achieve your desired learning outcomes.

Course coordinators and program directors should create opportunities for faculty to share ideas and methods. This collaborative exchange fosters innovation and consistent approaches across related courses. As you implement these changes, collect and utilize student feedback and performance data to evaluate the effectiveness of your approaches in developing targeted skills.

Support from teaching and learning centers, and specialized work groups examining different course types and pedagogical approaches, will significantly strengthen this process. These dedicated resources create platforms for ongoing dialogue, collaborative learning, and continuous improvement.

This dynamic approach creates an environment where teaching strategies evolve through practical experience, student outcomes, and faculty insights. Teaching methods continue to develop in alignment with defined learning outcomes and the changing needs of students.

You may notice that when faculty are actively involved in planning, pedagogical changes often begin emerging even before learning outcomes are fully defined. This organic evolution is a natural and beneficial part of the change process when insights are shared throughout the organization.

Milestone

A pedagogical approach supporting the defined learning outcomes for each course

Formulating an Assessment Model

10. Creating an assessment model for an individual course, an academic year, or the entire educational process

Skills development is a dynamic journey that unfolds over time. By establishing clear benchmarks at each stage and course level, you create opportunities for meaningful formative assessment. This assessment framework not only supports your educational transformation but also generates insights that help educators continually refine their teaching methods.

Don't let the current limitations of skill assessment tools delay your implementation. Assessment approaches naturally evolve and improve with practice. Focus on developing a model that considers both your ultimate goals and the expectations for students at each skill mastery level.

Take a practical approach to assessment rather than an "all-or-nothing" mindset. While courses often develop multiple skills, concentrate formal assessment on just a few core competencies to keep the process manageable for both faculty and students. Other skills can still be developed without requiring formal evaluation.

Effective assessment examines both the development process and final outcomes. You might initially draw guidance from external benchmarks like industry feedback on graduates, but ultimately your assessment methods should reflect your institution's unique educational approach. Maintain ongoing dialogue with faculty, involving them in both designing and implementing your assessment model. This collaborative approach ensures a comprehensive perspective that extends beyond individual courses.

Milestone

Implementation of a comprehensive skills assessment model that provides continuous evaluation across the full educational journey

Integrating Skills as Part of the Engineering Education Process at Afeka College

Implementation Phases at Afeka

This chapter presents a practical case study of skills integration within Afeka College's engineering curriculum. Building upon the systematic approach outlined in the previous chapter, we demonstrate how theoretical principles transform into actionable implementation with real-world challenges and solutions. While our example focuses on engineering education at Afeka, the methodology and insights are adaptable across diverse educational systems and professional fields. This real-world application illustrates effective strategies for institutions and educators working to embed skills development into their academic programs.

Identifying the Goal

1. Determining your focus—knowledge, skills, and values

We decided to define the ultimate Afeka graduate profile.

Afeka's journey began with fundamental questions about its educational mission: What defines our ideal graduate? Do our current graduates truly meet the requirements of the industry hiring them?

Since its establishment, Afeka College has prioritized strong industry alignment in its engineering programs, primarily through recruiting faculty with industry expertise and fostering ongoing dialogue with industry partners. A thorough evaluation of our graduate outcomes revealed that while knowledge transfer was robust, we needed a more systematic approach to developing and assessing personal and professional competencies. This insight led to developing a more comprehensive educational strategy that balances technical expertise with the soft skills essential for modern engineering practice.

We discovered that implementing this change required addressing several practical challenges, including faculty resistance to changing established teaching methods, concerns about diluting technical content, and questions about measuring soft skills development. By acknowledging these concerns openly and involving faculty in the solution process, we were able to build support for our approach.

With knowledge-based learning outcomes already well-established, the college's curriculum reform focused specifically on developing crucial personal and professional competencies—such as engineering skills, multilingual proficiency (English, Hebrew, and programming languages), liberal arts education, and core values. The reform's direction emerged through collaborative decision-making between college leadership and senior faculty, building upon Afeka's existing culture of cooperation—a critical foundation for such a transformative process.

Key Outcome at Afeka

The decision to define a holistic graduate profile encompassing knowledge, skills, and values and to integrate these essential skills and values into the learning outcomes across the educational process

Skills—Selection, Definition, and Assessment Metrics

2. Selecting the skills to be imparted throughout the educational process

We consolidated the key skills required of engineers in industry.

At Afeka College, we implemented a systematic approach in order to identify and define the critical competencies required of contemporary engineers. Our methodology involved analyzing and synthesizing skill definitions from both current industry standards and leading academic frameworks, ensuring our graduates possess the comprehensive skill set demanded by their future careers.

Our process of identifying and defining essential skills drew from three international sources that establish workforce requirements for modern engineers: the American Association of Colleges and Universities (AAC&U), the Accreditation Board for Engineering and Technology (ABET), and the World Economic Forum's (WEF) future skills framework.

ABET's Engineering Criteria 2000,[1] introduced in 1995, represented a revolutionary shift in engineering education evaluation. This framework transformed assessment from input-based metrics (curriculum content) to output-focused measures (learning outcomes). By surveying over 1,600 companies, ABET established eleven core learning outcomes and evaluation criteria. This groundbreaking approach emphasized the development of professional and personal competencies—including complex problem-solving, communication, and teamwork—alongside traditional technical knowledge.

The AAC&U's influential emolyer survey's[2] have maintained their relevance for over a decade, redefining post-secondary education success criteria. These publications expanded beyond traditional academic metrics to encompass lifelong professional and personal skill development, providing detailed rubrics and assessment methodologies for comprehensive student evaluation.

The WEF's 2020 identification of ten critical future workforce skills[3] reinforced the growing consensus that personal competencies, combined with professional skills, determine workplace adaptability—particularly crucial for engineers. This alignment reflects the evolution in professional development requirements.

Our analysis extended to comparing these international frameworks with the "21st-century skills" defined by the Israeli Ministry of Education. This examination revealed significant overlap in core competencies across systems, confirming universal agreement on skills essential for societal integration.

To ensure local relevance, Afeka College conducted a focused survey of 103 Israeli high-tech companies, asking employers to identify the five most critical skills for entry-level engineers. This regional consultation ensured our framework aligned with specific Israeli tech sector requirements.

A comprehensive comparison of these skill requirements appears in Table 1.

1 Yeargan, Jerry, et al. "ABET engineering criteria 2000." Proceedings Frontiers in Education 1995 25th Annual Conference. Engineering Education for the 21st Century. Vol. 2. IEEE, 1995.

2 Hart Research Associates. "Fulfilling the American dream: Liberal education and the future of work." Association of American Colleges and Universities (2018).

Finley, Ashley. "How College Contributes" to" Workforce Success: Employer Views on What Matters Most." Association of American Colleges and Universities (2021).

3 Brown, S., et al. "World Economic Forum: The future of jobs report 2020." (2020).

Table 1: Comparative Analysis of Core Engineering Competencies from Multiple Sources

SKILL/SOURCE	ABET	WEF	AAC&U	Afeka's High-Tech Industry Survey	Afeka's Graduate Profile
Effective Communication	✓			✓	✓
Engineering Problem-Solving		✓		✓	✓
Use of Modern Engineering Tools		✓		✓	✓
Professional and Social Values	✓		✓ Ethical reasoning and civic engagement	✓ Professional and ethical responsibility	✓ Professional, ethical and social responsibility
Teamwork	✓		✓	✓ Multidisciplinary teamwork	✓ Multidisciplinary teamwork
Needs-Based System Development	✓			✓	✓ Needs-Based system design & development
Life-long Learning	✓	✓	✓	✓	✓ Self-Directed learning
Design and Execution of Experiments	✓			✓	✓
Knowledge of Contemporary Issues	✓			✓	✓ Knowledge in fields other than engineering
Understanding of Global Contexts	✓		✓	✓	✓
Critical Thinking		✓	✓	✓	✓
Application of Mathematics, Science, and Engineering Knowledge	✓		✓	✓	✓
Multidisciplinary Perspective of Systems	✓		✓		✓
Mental Resilience		✓		✓	
Global Competency and English Proficiency			✓	✓	✓
Emotional Intelligence				✓	

We defined the profile of the Afeka engineering graduate.

Our intensive evaluation process culminated in a consensus on the ideal Afeka graduate profile. Beyond traditional engineering knowledge, we identified the core competencies that distinguish successful engineers in today's industry—thus producing a profile that encapsulates the ultimate product of our entire educational process. The profile integrates four personal skills we found to be most critical for engineers in the workplace: effective communication, critical thinking, self-directed learning, and collaborative teamwork across disciplines.

Key Outcome at Afeka

A mapping of the essential knowledge, skills and values that make up Afeka's ultimate graduate profile, including the four personal skills we decided to embed throughout the educational journey of our students

Figure 2: The Afeka Graduate Profile

3. Defining the selected skills

We discussed each skill until reaching a consensus on the definition.

The Teaching Committee at Afeka led a collaborative process to precisely define each professional skill within Afeka's engineering context. Drawing from established frameworks like ABET and AAC&U, we adapted international standards to align with both engineering requirements and Israeli cultural context. This inclusive approach engaged faculty in active dialogue, ensuring broad ownership of the final definitions.

Key Outcome at Afeka

Precise and contextually-appropriate definitions for each skill in the Afeka graduate profile, established through faculty consensus

Table 2: Textual Definitions of the Thirteen Skills in Afeka's Graduate Profile

Engineering Skills	
Integrative Learning	The progressive development of understanding and aptitude that students build throughout their academic journey, including both core curriculum and supplementary programs. This development begins with making basic connections between ideas and experiences, and advances to synthesizing knowledge and applying learning to new, complex situations both on and off campus.
Engineering Problem-Solving	A systematic process of developing, evaluating, and implementing strategies to address open-ended questions or achieve specific objectives.
Experimental Design and Implementation	The process of developing experimental protocols, conducting experiments, analyzing results, and formulating conclusions.

Personal Skills	
Written and Oral Communication	The ability to effectively convey thoughts, information, and ideas through both written and spoken means. Written communication focuses on developing and articulating ideas clearly and purposefully in text, while oral communication involves delivering structured presentations to individuals or groups. Both forms aim to achieve specific outcomes, whether informing, persuading, or fostering changes in understanding, attitudes, beliefs, or behaviors of the intended audience.
Critical Thinking	The comprehensive examination of topics, ideas, and events before formulating opinions or drawing conclusions.
Self-Directed Learning	The consistent engagement in meaningful learning activities aimed at enhancing one's knowledge, skills, and capabilities.
Teamwork	The effort invested by each team member in group tasks, reflected in their ability to communicate with other team members and in the quantity and quality of their contributions to team discussions.

Broad-based Education	
Interdisciplinary Knowledge	Knowledge and insights from non-engineering fields that directly or indirectly relate to engineering, including psychology, economics, history, philosophy, ethics, and other disciplines.
Global Learning	The engaged study of interdependent global systems and complex legacies—natural, physical, social, cultural, economic, and political—and their implications for people's lives and Earth's sustainability. Through global learning, students are expected to achieve three outcomes: 1. Become informed, unbiased, and responsible actors. 2. Understand how their actions impact both local and global communities. 3. Address the world's most pressing and persistent issues through collaboration and in the most fair and just manner.

Values	
Ethical Reasoning	The ability to evaluate the rightness of human conduct through examining adopted values and social contexts, applying diverse perspectives to human dilemmas, and considering the implications of alternative courses of action.
Civic Engagement	The commitment to create change in our communities' civic life through combining knowledge, skills, values, and motivation to promote quality of life through both political and non-political processes.

Languages	
Hebrew and English Language Proficiency	The ability to extract and construct meaning through interaction with written language, encompassing reading comprehension and written communication across various genres and styles. This includes working with different writing technologies and integrating text, data, and images. These communication skills develop through repeated experiences throughout the curriculum.
Programming	The skill of formulating problem solutions through code, enabling engineers to express solutions that will be implemented by others. This fundamental engineering competency develops the ability to articulate solution processes clearly and precisely.

4. Establishing skill proficiency levels and assessment metrics

We developed a three-tiered proficiency scale for each skill, with measurable assessment criteria for each level.

At Afeka, this framework was inspired by the AAC&U's Valid Assessment of Learning in Undergraduate Education (VALUE) Rubrics[4], which defines four proficiency levels for professional and personal competencies, ranging from introductory to mastery level.

Our approach is founded on the understanding that skill development is a continuous process. This perspective required us to carefully examine the progression of each skill, identifying the distinct characteristics of each level, and most importantly, determining how to effectively achieve our desired learning outcomes. We focused on understanding how each skill develops and how to best structure and reinforce it within the comprehensive educational journey of our students.

In our analysis, we found that the four levels in the VALUE Rubrics didn't provide sufficiently distinct stages of progression for our purposes. We therefore opted for three clearly defined levels—basic, intermediate, and advanced. Rather than simply defining end-state competencies (how we expect these skills to manifest in Afeka graduates), we took a systematic approach: We first defined the desired outcomes at the advanced level, then worked backward to establish appropriate benchmarks for the intermediate and basic levels.

While AAC&U serves the broader academic community beyond engineering institutions, we adapted the VALUE framework specifically for the engineering context at Afeka: We modified the proficiency levels to align with our engineering curriculum, ensuring that the language, context, and content would facilitate better integration of these skills alongside technical knowledge in the learning process.

For illustration, we have included both the VALUE Rubric for social responsibility and the faculty-developed definition of this skill at Afeka, demonstrating how we've adapted these concepts for our engineering focus.

4 Association of American Colleges and Universities. (2009). Valid Assessment of Learning in Undergraduate Education (VALUE). Author. https://www.aacu.org/initiatives/value

Association of American Colleges and Universities (2009) Civic Engagement VALUE rubric [5]

	Capstone 4	Milestones 3	2	Benchmark 1
Diversity of Communities and Cultures	Demonstrates evidence of adjustment in own attitudes and beliefs because of working within and learning from diversity of communities and cultures. Promotes others' engagement with diversity.	Reflects on how own attitudes and beliefs are different from those of other cultures and communities. Exhibits curiosity about what can be learned from diversity of communities and cultures.	Has awareness that own attitudes and beliefs are different from those of other cultures and communities. Exhibits little curiosity about what can be learned from diversity of communities and cultures.	Expresses attitudes and beliefs as an individual, from a one-sided view. Is indifferent or resistant to what can be learned from diversity of communities and cultures.
Analysis of Knowledge	Connects and extends knowledge (facts, theories, etc.) from one's own academic study/field/discipline to civic engagement and to one's own participation in civic life, politics, and government.	Analyzes knowledge (facts, theories, etc.) from one's own academic study/field/discipline making relevant connections to civic engagement and to one's own participation in civic life, politics, and government.	Begins to connect knowledge (facts, theories, etc.) from one's own academic study/field/discipline to civic engagement and to tone's own participation in civic life, politics, and government.	Begins to identify knowledge (facts, theories, etc.) from one's own academic study/field/discipline that is relevant to civic engagement and to one's own participation in civic life, politics, and government.
Civic Identity and Commitment	Provides evidence of experience in civic-engagement activities and describes what she/he has learned about her or himself as it relates to a reinforced and clarified sense of civic identity and continued commitment to public action.	Provides evidence of experience in civic-engagement activities and describes what she/he has learned about her or himself as it relates to a growing sense of civic identity and commitment.	Evidence suggests involvement in civic-engagement activities is generated from expectations or course requirements rather than from a sense of civic identity.	Provides little evidence of her/his experience in civic-engagement activities and does not connect experiences to civic identity.
Civic Communication	Tailors communication strategies to effectively express, listen, and adapt to others to establish relationships to further civic action.	Effectively communicates in civic context, showing ability to do all of the following: express, listen, and adapt ideas and messages based on others' perspectives.	Communicates in civic context, showing ability to do more than one of the following: express, listen, and adapt ideas and messages based on others' perspectives.	Communicates in civic context, showing ability to do one of the following: express, listen, and adapt ideas and messages based on others' perspectives.
Civic Action and Reflection	Demonstrates independent experience and shows initiative in team leadership of complex or multiple civic engagement activities, accompanied by reflective insights or analysis about the aims and accomplishments of one's actions.	Demonstrates independent experience and team leadership of civic action, with reflective insights or analysis about the aims and accomplishments of one's actions.	Has clearly participated in civically focused actions and begins to reflect or describe how these actions may benefit individual(s) or communities.	Has experimented with some civic activities but shows little internalized understanding of their aims or effects and little commitment to future action.
Civic Contexts/ Structures	Demonstrates ability and commitment to collaboratively work across and within community contexts and structures to achieve a civic aim.	Demonstrates ability and commitment to work actively within community contexts and structures to achieve a civic aim.	Demonstrates experience identifying intentional ways to participate in civic contexts and structures.	Experiments with civic contexts and structures, tries out a few to see what fits.

5 Association of American Colleges and Universities. (2009). Inquiry and analysis VALUE rubric. https://www.aacu.org/initiatives/value-initiative/value-rubrics/value-rubrics-civic-engagement

Key Outcome at Afeka

Assessment criteria and definitions for a three-tiered proficiency framework, developed and finalized by the College Teaching Committee for each identified skill

Table 3: Afeka's Three-Tiered Proficiency Framework for All Skills[6]

Engineering Skills

	Basic	Intermediate	Advanced
Integrative Learning Assessment Metrics: Degree of connection made to practical experience.	The ability to identify connections between experiences and concepts that appear similar.	The ability to compare practical experience with academic knowledge to identify differences and similarities.	The ability to create connections between practical experience and ideas, and transfer learning to new situations.
Engineering Problem-Solving Assessment Metrics: Accuracy of problem definition; Appropriateness of strategy identification; Quality of solution implementation.	The ability to identify one or more potential approaches to problem-solving without applying them to specific contexts.	The ability to identify and implement a single problem-solving approach in a specific context.	The ability to identify and implement multiple problem-solving approaches in a specific context.
Planning and Execution of Experiments Assessment Metrics: Quality of topic selection; Effectiveness of planning process; Depth of analysis and conclusions; Understanding of limitations and implications.	The ability to identify general research topics and demonstrate initial experimental planning capability.	The ability to identify focused research topics and partially develop research methodology.	The ability to identify focused research topics and fully develop methodology or theoretical framework, including evidence organization and discussion.

Personal Skills

	Basic	Intermediate	Advanced
Written and Oral Communication Assessment Metrics: Level of organizational clarity; Quality of language use; Effectiveness of presentation delivery; Accuracy of citations; Clarity of central message.	The ability to partially present a topic and use relevant content and information sources to develop ideas.	The ability to present a topic and consistently address various aspects, information or analysis supporting the presented content.	The ability to present a topic and consistently address various aspects, information or analysis supporting the presented content, including broader contexts.
Critical Thinking Assessment Metrics: Depth of topic explanation; Quality of supporting evidence; Strength of connections made; Clarity of position taken.	The ability to present a topic from information sources without interpretation, evaluation, or position taking.	The ability to present a topic from information sources with some degree of interpretation, evaluation, and position taking.	The ability to present a topic from information sources with sufficient interpretation and evaluation enabling comprehensive analysis or synthesis.
Self-Directed Learning Assessment Metrics: Level of demonstrated curiosity; Degree of initiative shown; Extent of independent work; Effectiveness of knowledge transfer.	The ability to conduct surface exploration of a topic with occasional reference to prior learning, without applying acquired knowledge and skills.	The ability to explore a topic with some depth, with partial reference to prior learning and attempts to apply acquired knowledge and skills.	The ability to conduct deep exploration of a topic with explicit reference to learning and skills acquired in an innovative and creative way.
Teamwork Assessment Metrics: Quality of contributions in team meetings; Effectiveness in facilitating others' participation; Level of contribution outside meetings; Impact on team environment.	The ability to share ideas with the team without actively facilitating collaborative work.	The ability to share ideas and approaches that advance both the team's work and encourages the participation of other members.	The ability to propose collaborative approaches that enable team contributions of team members through synthesis of ideas and building upon the suggestions of others.

Broad-Based Education

	Basic	Intermediate	Advanced
Interdisciplinary Knowledge Assessment Metrics: Depth of interdisciplinary insights demonstrated; Quality of multidisciplinary connections made.	The ability to connect subject matter from different disciplines to engineering.	The ability to understand relationships between different disciplines and engineering.	The ability to critically analyze interdisciplinary connections and identify links to additional fields.
Global Learning Assessment Metrics: Range of cultural perspectives considered; Level of personal responsibility demonstrated; Depth of social responsibility shown; Understanding of global systems; Effectiveness of knowledge application in contemporary contexts.	The ability to identify multiple perspectives while maintaining one's own viewpoint.	The ability to identify and explain multiple perspectives and examine them in different contexts.	The ability to evaluate diverse perspectives on complex issues within various systems, and after thoughtful consideration, the ability to apply them.

Values

	Basic	Intermediate	Advanced
Ethical Reasoning Assessment Metrics: Accuracy in identification of ethical issues; Depth of different viewpoint analysis; Quality of ethical concept application.	The ability to identify basic ethical issues.	The ability to identify basic ethical issues and partially understand the complexity of relationships between them.	The ability to identify ethical issues in complex, multi-layered contexts, including the relationships between issues.
Civic Engagement Assessment Metrics: Depth of knowledge analysis; Effectiveness of civic communication; Understanding of civic structures and connections.	The ability to recognize academic knowledge relevant to civic engagement.	The ability to connect academic knowledge to civic engagement and communicate it within civic contexts.	The ability to connect academic knowledge to civic engagement and create communication strategies aimed at establishing connections for civic action.

Languages

	Basic	Intermediate	Advanced
Hebrew and English Language Proficiency Assessment Metrics: Level of comprehension shown; Quality of text engagement; Depth of content development	The ability to understand vocabulary in a way that enables reformulating or summarizing the information that the text conveys.	The ability to evaluate messages conveyed in text and draw basic conclusions from the text.	The ability to evaluate texts with scientific meaning and relevance across different fields of knowledge, and examine them according to their contribution and implications.
Programming Assessment Metrics: Quality of working code produced; Effectiveness of code additions to existing systems; Depth of code comprehension and understanding	The ability to identify variable types, input/output, use conditional statements, loops and functions, and read simple programs.	The ability to write quality code with structure that reflects the content.	The ability to characterize a software system, implement it, and choose the appropriate programming language for solving the problem.

[6] Abbreviated version shown. For the complete framework, please contact: President.Office@afeka.ac.il.

Identifying Skills Development Gaps in the Existing Educational Process

5. Mapping existing skills development across the curriculum

We identified which skills faculty members were already incorporating into their courses through current teaching practices.

After completing the definition phase, we undertook a comprehensive assessment to understand how skills were currently being integrated across the college curriculum—specifically identifying where personal skills were already being developed in practice. For example, we examined whether courses included assignments in English or incorporated team-based learning. This mapping process would serve as our baseline for future improvements by allowing us to compare the current state against our desired outcomes and focus our efforts where changes were most needed.

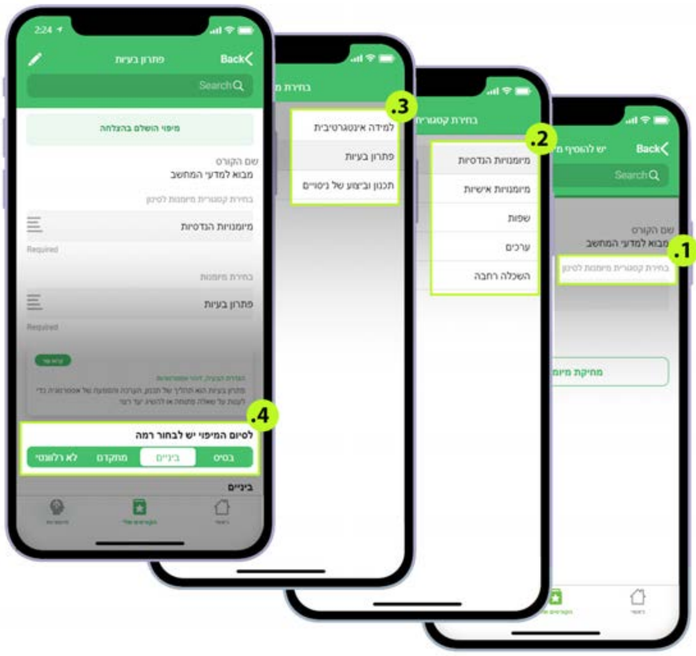
Course coordinators reviewed the syllabi of over 300 courses, mapping each one to our skills matrix and identifying both the skills being developed and the corresponding proficiency levels. During this process, we identified a crucial distinction: some skills might not be relevant to certain courses, which differs from skills that could be included but weren't yet part of the syllabus. To ensure accurate mapping of the current state, we developed a dedicated application that allowed faculty to build comprehensive course profiles that included both required competencies and their corresponding proficiency levels. Faculty members were asked to address all thirteen core skills identified by the college when completing these profiles.

Figure 3: Screenshot from Afeka's Skills Mapping Application User Guide

Mapping Skills: Individual Course Interface

To add a skill to a course, complete these 4 steps:

1. Click "Select skill category" for filtering
2. Choose one of 5 categories
3. Select the skill to map to the category
   Tip: Selecting a skill displays additional information about that skill
4. Select the required proficiency level
   Important! If the skill is not relevant to the course, select "Not Relevant"
   Tip: Selecting a proficiency level displays informatic about the relevance to this skill



The mappings completed through the application were converted into detailed Excel spreadsheets for each program and course. This format made it easy to identify both existing content and the progression (or gaps) in skills development throughout the educational process.

Key Outcome at Afeka

Detailed Excel spreadsheets for each academic program that document all courses in curriculum sequence, identify skills integrated into each course, and specify corresponding proficiency levels for each skill

Figure 4: A Baseline Skills Development Journey of an Afeka Medical Engineering Student—Resulting from the Mapping Done Using the App

Course	Year	Sem	Engineering S	
			Integrative Learning	Problem Solving
Introduction to Medical Technologies	1	1	Basic	Basic
Chemistry for Medical Engineering	1	1	Basic	Basic
Linear Algebra	1	1	Basic	Basic
Calculus 1	1	1	Basic	
Cell Biology	1	2	Basic	Basic
Standard Deep Equations	1	2		
Calculus 2	1	2		Basic
Thermodynamics	2	1	Basic	Intermediate
Physiology for Engineers	2	1	Intermediate	Intermediate
Solid Mechanics 1	2	1	Basic	Intermediate
Solid Mechanics 2	2	2	Intermediate	Intermediate
Flow Mechanics	2	2	Basic	Basic
Electronics	2	2		
Computational and algorithmic tools in medical	2	2		Intermediate
Medical Electronics Lab	2	2	Intermediate	Basic
Physiology and Physiological Systems Control	2	2	Intermediate	Basic
Physics – electricity and magnetism	2	2	Basic	Intermediate
Elecricity Physics Lab	2	2	Basic	Intermediate
Wave Theory for Medical Engineering	2	2	Basic	Intermediate
Modern Physics for Medical Engineering	2	2	Basic	Intermediate
Partial Deep Equations	2	2		
Numerical analysis	3	1		Basic
Physiological mechanics of the skeletal and	3	1	Advanced	Advanced
Applied Lab in Medical Engineering	3	1	Intermediate	Intermediate
Digital Circuits in Medicine	3	1	Intermediate	
Medical Radiology – Imaging and Treatment	3	1	Intermediate	Intermediate
Final Projects in Medical Engineering	3	2	Advanced	Advanced
Materials and Implants in medical Engineering	3	2	Advanced	Advanced
Heat and Mass transfer in Biological Systems	3	2		Intermediate
Computational Methods in Engineering	3	2	Intermediate	Intermediate
Process Control in Computerized Systems	3	2		
Image Processing and Recognition	3	2	Intermediate	Intermediate
Introduction to probability	3	2		Basic
Exposure to industry companies and medical	4	1	Advanced	Advanced
Medical Ethics	4	1	Intermediate	Intermediate
Advanced topics in Biomaterials	4	1	Advanced	Advanced
Advanced Flow and Medical Applications	4	1	Advanced	Advanced
Advanced Image Processing and Medical	4	1	Intermediate	Intermediate
General and Systems Pathology	4	1	Intermediate	Intermediate

6. Pinpointing the gaps between the current and the desired skills development process

We identified gaps between our desired skills development framework and current practices and updated our skills development mapping.

At Afeka, comparing the application's mapping results for each course with the skill definitions provided an essential foundation for understanding how skills were actually being integrated across the curriculum. This mapping process proved crucial and sparked meaningful discussions within our academic departments. Key questions emerged: Should we aim to develop all identified skills throughout the entire degree program? Were our defined proficiency levels realistic? What differences existed between program tracks? What elements were missing from our ideal framework?

Considerable time was invested in collaborative discussions across academic schools and teaching committees. While the mapping process revealed fewer gaps than expected, it proved highly valuable by enabling faculty, teaching committees, and department heads to learn from each other's practices. This exchange enriched discussions and highlighted various practical approaches to skills integration. Through both group and individual work, faculty members were able to incorporate new tools for strengthening skills development within their course materials.

This mapping and analysis process with course coordinators led to an important insight: to prevent overload and ensure effective skills development, courses should focus on no more than three skills each. Course coordinators were therefore asked to limit their selection to three skills per course, ensuring in-depth and accurate skill development for students.

Key Outcome at Afeka

Updated Excel spreadsheets for each academic program,
showing all courses in curriculum sequence, along with their selected skills for development and required proficiency levels. Together, these elements map out the complete educational pathway needed to develop our target graduate profile

Figure 5: The desired skills development mapping (preliminary) for an Afeka biomedical engineering student, reflecting the focused approach developed in collaboration with course coordinators

Course	Year	Sem	Personal Skill		
			Written & oral communication	Critical Thinking	Self-le
Introduction to Python Programming	1	1			
Chemistry for Biomedical Engineering	1	1			
Introduction to Medical Technology	1	1		Intermediate	
Calculus 1	1	1	Basic	Basic	
Linear Algebra	1	1	Basic	Basic	
Cell Biology	1	2			
Engineering Graphics for Biomedical Engineering	1	2		Basic	
Calculus 2	1	2		Basic	
Physics – Mechanics	1	2			
Introduction to Probability	1	2		Basic	
Ordinary Differential Equations	1	2		Basic	
Introduction to Electrical Engineering and	2	1			Interm
Physiology for Engineers	2	1		Intermediate	
Solid Mechanics 1	2	1		Basic	
Thermodynamics	2	1		Intermediate	
Physics – Electricity and Magnetism	2	1			
Harmonic Analysis	2	1		Basic	
Complex Functions	2	1	Basic		
Physics Laboratory – Mechanics	2	1	Basic		
Physiology and Control Systems in the Human	2	2	Basic		
Electronics	2	2			
Medical Electronics Laboratory	2	2	Intermediate		
Computational Tools and Algorithms in	2	2			
Solid Mechanics 2	2	2		Basic	
Fluid Mechanics	2	2	Basic		Bas
Partial Differential Equations	2	2		Basic	
Wave Theory for Biomedical Engineering	2	2			
Modern Physics for Biomedical Engineering	2	2			
Practical Laboratory in Biomedical Engineering	3	1			
Control and Linear Systems	3	1			Interm
Physiological Mechanics of the Skeletal and	3	1	Intermediate		Interm
Digital Signal Processing	3	1			
Medical Radiation – Imaging and Treatment	3	1			
Medical Sensors	3	1			
Clinical Engineering and Medical Technology	3	1	Intermediate		
Numerical Analysis	3	1		Basic	
Databases	3	1			
Data Mining	3	2			
Process Control in Computerized Systems	3	2			
Digital Systems in Medicine	3	2			
Image Processing and Recognition	3	2			
Heat and Mass Transfer in Biological Systems	3	2			

Course	Year	Sem	Person	
			Written & oral communication	Critical Thinking
Introduction to Python Programming	1	1		
Chemistry for Biomedical Engineering	1	1		
Introduction to Medical Technology	1	1		Intermediate
Calculus 1	1	1	Basic	Basic
Linear Algebra	1	1	Basic	Basic
Cell Biology	1	2		
Engineering Graphics for Biomedical Engineering	1	2		Basic
Calculus 2	1	2		Basic
Physics – Mechanics	1	2		
Introduction to Probability	1	2		Basic
Ordinary Differential Equations	1	2		Basic
Introduction to Electrical Engineering and	2	1		
Physiology for Engineers	2	1		Intermediate
Solid Mechanics 1	2	1		Basic
Thermodynamics	2	1		Intermediate
Physics – Electricity and Magnetism	2	1		
Harmonic Analysis	2	1		Basic
Complex Functions	2	1	Basic	
Physics Laboratory – Mechanics	2	1	Basic	
Physiology and Control Systems in the Human	2	2	Basic	
Electronics	2	2		
Medical Electronics Laboratory	2	2	Intermediate	
Computational Tools and Algorithms in	2	2		
Solid Mechanics 2	2	2		Basic
Fluid Mechanics	2	2	Basic	
Partial Differential Equations	2	2		Basic
Wave Theory for Biomedical Engineering	2	2		
Modern Physics for Biomedical Engineering	2	2		
Practical Laboratory in Biomedical Engineering	3	1		
Control and Linear Systems	3	1		
Physiological Mechanics of the Skeletal and	3	1	Intermediate	
Digital Signal Processing	3	1		
Medical Radiation – Imaging and Treatment	3	1		
Medical Sensors	3	1		
Clinical Engineering and Medical Technology	3	1	Intermediate	
Numerical Analysis	3	1		Basic
Databases	3	1		
Data Mining	3	2		
Process Control in Computerized Systems	3	2		
Digital Systems in Medicine	3	2		
Image Processing and Recognition	3	2		
Heat and Mass Transfer in Biological Systems	3	2		
Materials in Biomedical Engineering and	3	2		

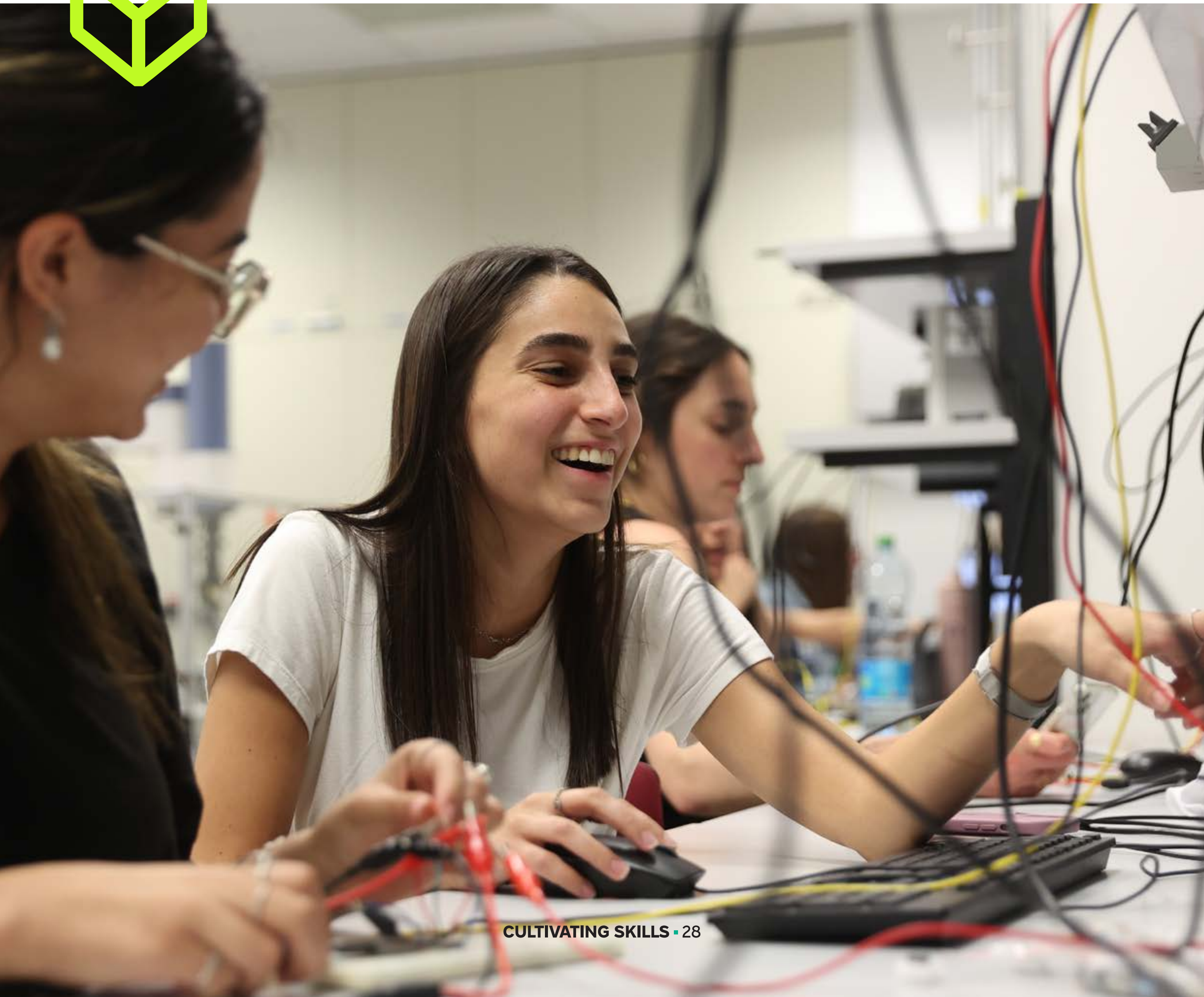
Revising the Educational Process to Enhance Skills

7. Aligning course learning outcomes with the multi-tiered proficiency scale to create a progressive skills development curriculum

We updated our course syllabi to align with our desired framework.

As previously mentioned, each desired learning outcome was thoroughly defined in writing, with specific outcomes for three proficiency levels—basic, intermediate, and advanced. Our goal was for all students to achieve advanced-level proficiency in every aspect of the graduate profile by graduation. Even after establishing these three proficiency levels, we didn't treat the definitions as definitive. Instead, we continuously evaluated their relevance and adjusted them as needed. We realized that definitions needed to be intentionally broad to allow faculty flexibility in adapting course content and delivery methods to meet these outcomes. This approach to formulating learning outcomes helped create a comprehensive picture of the college's pedagogical structure while preserving academic freedom.

Our underlying assumption was that teaching faculty are best positioned to determine which tools most effectively support learning in their courses. The process is overseen by academic leadership in close collaboration with faculty, who identify how best to cultivate the required skills and align them with appropriate proficiency levels across their courses.



Key Outcome at Afeka

Updated syllabi for all courses across all academic programs, incorporating both knowledge-based learning outcomes and skills-based learning outcomes according to our desired educational framework

Figure 6: Sample Course Syllabus Showing Both Academic and Skills Learning Outcomes

Medical Engineering Program Course 50121: Physiological Mechanics of the Musculoskeletal System

Course Overview	This course covers key topics in biomechanics, including: historical development of biomechanics; skeletal system structure and functions; bone types and their biomechanical properties; linear elasticity; joint types; skeletal muscle properties and functions; linear viscoelasticity; major joints of the human body; static equilibrium in joints; human body kinematics and dynamics; and gait analysis.
Academic Learning Outcomes	1. Students will understand: • The structure and function of the skeletal system; • Different types of joints and their characteristics; • Properties and functions of skeletal muscles; • Principles of linear viscoelasticity. 2. Students will integrate knowledge from prerequisite courses to solve complex problems in biomechanics by: • Analyzing major human joints and calculating their motion characteristics; • Determining muscle forces during both static and dynamic joint conditions; • Evaluating skeletal system stresses under various loading conditions. 3. Students will create and present a scientific poster in English on a biomechanics topic.
Skills Development Outcomes	1. Problem Solving: Problem definition and strategy selection. Students should be able to identify and implement an appropriate solution approach within a specific context. 2. Communication: Organization, language use, presentation skills, proper citations, and message clarity. Students should be able to present topics clearly, consistently addressing multiple aspects while supporting claims with relevant evidence. 3. Self-Directed Learning: Intellectual curiosity, initiative, independent work, and knowledge application Students should be able to explore topics in depth, building on prior knowledge while applying newly acquired skills.

8. Making resources accessible and establishing management infrastructure

We developed dedicated tools to help manage the change initiative.

To facilitate the management of our transformative process, we developed two key infrastructure tools to support the process from start to finish:

- **A Skills Mapping App:** The previously described application, which was initially used for skills mapping and continues to serve faculty members in tracking skills development progression.
- **A Mapping Database:** A comprehensive mapping file that tracks skill proficiency levels (from 1-3) across all college courses. This tool enables faculty to view skill integration from multiple perspectives, including individual courses and entire programs, while tracking the progression of their development from foundational to advanced courses. As an accessible and user-friendly resource, the mapping helps identify gaps in skills development at both course and program levels, facilitates focused discussions, supports collaborative decision-making through a holistic and transparent perspective.

Key Outcome at Afeka

Infrastructure and tools established to support the implementation of our skills development framework throughout the educational process

Managing the Implementation of Change in the Educational Process

9. Developing pedagogical strategies that support attaining the desired learning outcomes

The development of pedagogical approaches for each course involved an intensive, year-long process. Building on initial course content and delivery method mappings, teaching committees and department heads worked together to refine our overall approach. They focused on precisely defining proficiency levels and examining courses across engineering schools to ensure appropriate progression of skills development. This collaborative effort involved extensive peer discussions within and across departments, with faculty members developing and sharing pedagogical approaches. Initially, we focused on two fundamental skills—critical thinking and teamwork—before gradually incorporating additional ones.

Faculty heads played a crucial role in engaging all faculty members in this process, particularly those who weren't involved in the initial mapping phase.

To further support this transformation, faculty members continue to regularly participate in workshops conducted by external experts on incorporating skills development into their courses. While these workshops are optional, they have seen increasing participation. The college has also established support mechanisms to encourage faculty to develop new materials and teaching methods based on these workshop experiences.

Key Outcome at Afeka

The expansion of teaching methods beyond traditional lectures to include active skills development

Six years into the process, about half of Afeka's courses have adopted these new pedagogical approaches

Formulating an Assessment Model

10. Creating an assessment model for an individual course, an academic year, or the entire educational process

Refining and focusing skill definitions was crucial in developing assessment frameworks for each course. In discussions with Afeka faculty, many indicated they were developing more skills than those initially mapped in their courses. This highlighted the need to focus on core skills with agreed-upon assessment criteria before moving forward with evaluation. A clear guideline emerged: faculty should only designate skills they intended to formally assess as part of course learning outcomes. This streamlining process led to limiting each course to a maximum of three skills for assessment.

Students are informed about skills assessment as part of the overall course evaluation framework, ensuring transparency regarding assessment criteria. We continue to explore various approaches to skills assessment in collaboration with experts in skills development and evaluation.

Key Outcome at Afeka

We are currently evaluating various approaches to skills assessment

For now, each course integrates up to three selected skills into it assessment framework

Conclusion

The modern world is experiencing exponential change: knowledge is evolving, technologies are reshaping our familiar reality, and every aspect of life is being transformed. To succeed, we must adapt to these rapid changes—as must institutions and nations seeking to remain relevant in this evolving landscape. Understanding our responsibility to shape graduates who can thrive in this reality led us on a journey to align our educational process with both present and future needs.

Afeka's curriculum redesign process to align with our defined graduate profile is a multi-year endeavor that continues to evolve. We believe that learning is at the heart of the educational process, with every course and activity serving as tools to develop our target graduate profile—encompassing the necessary knowledge, skills, and values. Achieving desired learning outcomes at the individual level requires harmony between all educational components, both inside and outside the classroom. Therefore, we implemented changes across multiple parallel tracks, with mutual learning and synchronization, always guided by our vision of the graduate engineer profile.

While this is undoubtedly a long-term process, its foundational elements are essential for professional implementation, with each phase crucial for success. Equally important is engaging stakeholders in ways that give them ownership of the process, allowing each to lead within their domain.

It is important for us to emphasize that our driving vision is that skills development is a continuous, multi-stage process spanning multiple systems—from formal and informal education, through military service, higher education, and professional training, to employment. We stress the importance of defining this as a comprehensive national initiative with a clear shared vision:

To provide all students in Israel with access to quality STEM education that imparts knowledge, skills, and values, thereby enhancing their readiness for higher education and workforce integration; strengthening Israel's international position as a leader in STEM and innovation; and building skilled, quality-driven, and values-based national human capital.

Authors

Prof. Ami Moyal

Prof. Ami Moyal is President of Afeka—The Academic College of Engineering in Tel Aviv. He holds a Ph.D. in Electrical and Computer Engineering from Ben-Gurion University and specializes in speech recognition. His extensive management experience spans various roles in the high-tech industry, including CEO of NSC (Natural Speech Communication), a speech recognition technology company. Before becoming President of Afeka, he established and led the Afeka Center for Language Processing and served as Head of the School of Electrical Engineering. He also served as Chairman of ISEF (The Israel Scholarship Education Foundation) Israel, a foundation promoting social mobility through higher education and of the Center for Educational Technology (CET), Israel's leading provider of advanced technologies for pedagogical solutions.

Prof. Moyal's unique combination of experience in academia, industry leadership, and educational innovation has equipped him with the multidimensional perspective needed to successfully lead Afeka's strategic initiative to transform engineering education, adapting it to meet the evolving needs of both industry and a new generation of students by creating a competency-based model that bridges theoretical knowledge with practical application and skills development in order to prepare students for the evolving demands of the modern workplace.

Prof. Anat Ratnovsky

Prof. Anat Ratnovsky serves as Vice President for Academic Affairs at Afeka—The Academic College of Engineering in Tel Aviv. She holds a B.Sc. in Mechanical Engineering from the Technion and both M.Sc. and Ph.D. degrees in Biomedical Engineering from Tel Aviv University.

After completing her postdoctoral research at Harvard University, she joined Afeka's faculty in 2006 and later served as Head of the School of Medical Engineering. Her research combines experimental studies, signal processing, and machine learning algorithms to investigate both the musculoskeletal and respiratory systems, encompassing both fundamental research and practical applications.

Dr. Irma Jan

Dr. Irma Jan heads the Center for Promoting Teaching at Afeka—The Academic College of Engineering in Tel Aviv. She holds a B.Sc. in Mathematics and Statistics from Bar-Ilan University, and both M.A. and Ph.D. degrees in Science and Technology Education from Ben-Gurion University.

Her doctoral research focused on "Developing probabilistic understanding and thinking through experiential and interactive learning environments–the case of gifted students". Before joining Afeka, she served as Chief Supervisor for Mathematics at Israel's Ministry of Education, where she oversaw mathematics education across all educational levels, while also teaching mathematics and mathematics education.

Michal Gishri

Michal Gishri serves as Chief of Staff to the President at Afeka—The Academic College of Engineering in Tel Aviv. She holds an M.A. in Linguistics from Tel Aviv University and B.A. from Northwestern University. She also brings teaching experience from both early childhood education and higher education.

Throughout her tenure at Afeka, she has been involved in key decision-making processes across multiple aspects of the college's educational transformation initiative. In her initial role, she managed internal communications to foster a supportive organizational culture during the change process. In her current position, she oversees the development of Afeka's ecosystem for promoting STEM education across the educational continuum, while leading the college's external communications on this initiative.

Keren Ben-Natan Krueger

Keren Ben-Natan Krueger is an expert consultant specializing in national human capital development and stakeholder engagement. She brings extensive experience in workforce skills assessment and development, and has served on the steering committee for Afeka's National Human Capital in Engineering Conference since its establishment in 2015.

A retired IDF lieutenant colonel, she holds an M.A. in Organizational Behavior from Tel Aviv University and is a graduate of the IDF's Mandel Educational Leadership Program. Her career spans over 30 years in human resources strategy, research, and policy development, both in the IDF and other organizations, with particular emphasis on the technology sector.

AFEKA

The Academic College of Engineering in Tel Aviv

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