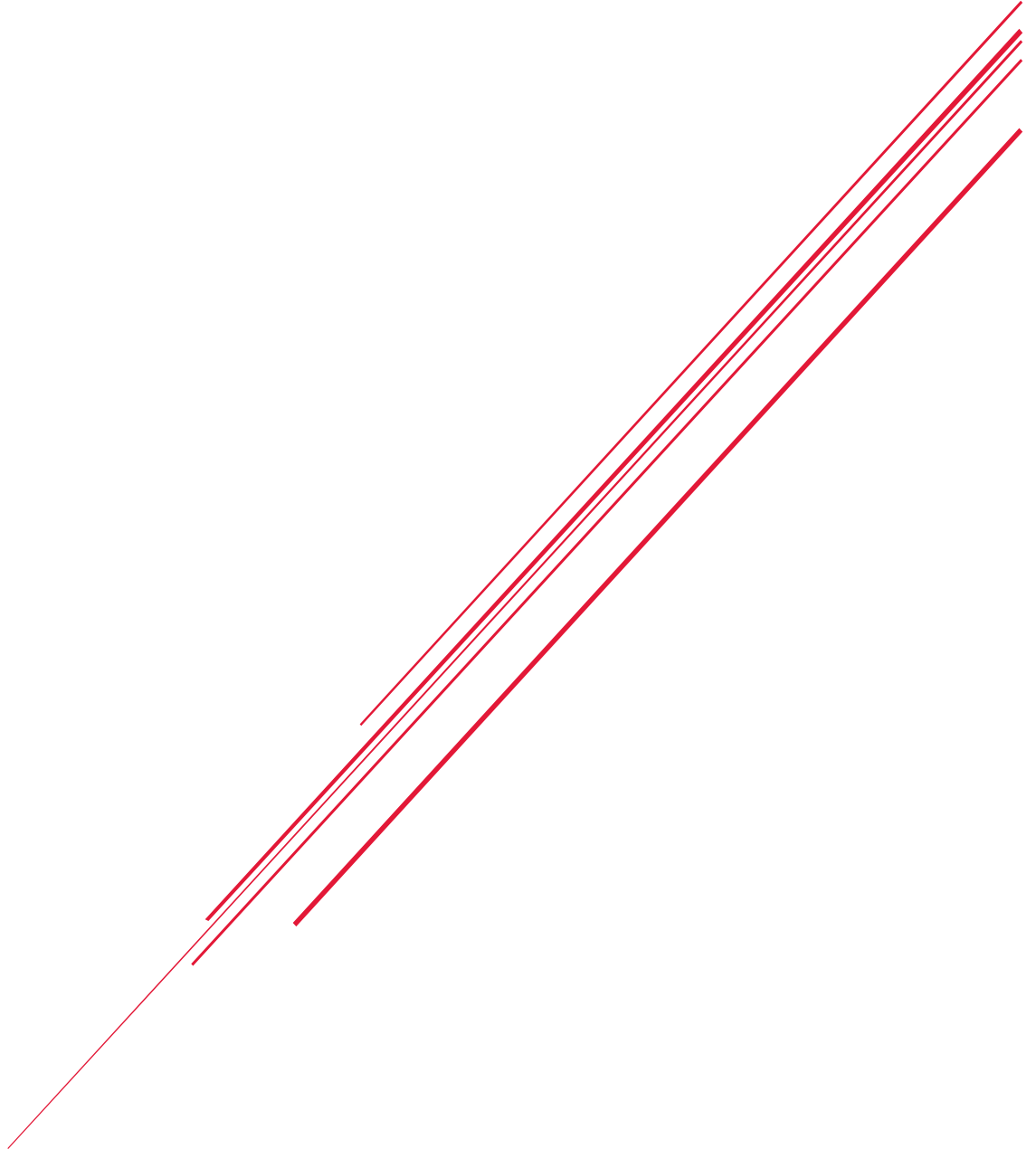




ORTA DOĞU TEKNİK ÜNİVERSİTESİ

**CENTER FOR SCIENCE, TECHNOLOGY, ENGINEERING, AND
MATHEMATICS EDUCATION**

2025 ANNUAL ACTIVITY REPORT



**JANUARY 2026
ANKARA**



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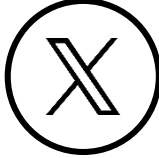
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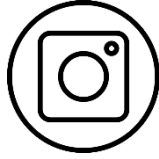
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ABBREVIATIONS

ABE	Amgen Biotechnology Experience
AI	Artificial Intelligence
AR	Augmented Reality
ATOM	Animation Technologies and Game Development Center
BILTEMM	Center for Science, Technology, Engineering, and Mathematics Education
CEIT	Computer Education and Instructional Technology
DataSETUP	Promoting Data Science Education for Teacher Education at the University Level
ECE	Early Childhood Education
FEDU	Faculty of Education
ESE	Elementary Science Education
ETKIM	Educational Technology Incubation and Innovation Center
EU	European Union
FLE	Foreign Language Education
FLL	FIRST® LEGO® League
GGJ	Global Game Jam
LAB	Learn-Ask-Build
MoNE	Ministry of National Education
MSE	Mathematics and Science Education
METU	Middle East Technical University
STEAM	Science, Technology, Engineering, Arts, and Mathematics
ISKUR	Türkiye Employment Agency
STEM	Science, Technology, Engineering, and Mathematics
TBD	The Informatics Association of Turkey
TEDU	TED University
TEKMER	METU-KOSGEB (Small and Medium Enterprises Development Organization) Technology Development Center
TUBITAK	The Scientific and Technological Research Council of Türkiye
TUBITEM	Türkiye Science and Technology Centers Summit
VR	Virtual Reality
YEGITEK	Innovation and Education Technologies General Directorate

FOREWORD

As the Middle East Technical University (METU) Center for Science, Technology, Engineering, and Mathematics Education Research and Practice (BILTEMM/METU STEM Center), we have completed the year 2025 through productive, multi-stakeholder, and impact-oriented activities in the areas of education, research, and community engagement.

Since its establishment, BILTEMM has aimed to contribute to the advancement of STEM and STEAM education in Türkiye, support teachers and pre-service teachers with the knowledge and competencies required in the twenty-first century, and foster students' interest in science, technology, engineering, and mathematics. This mission extends beyond keeping pace with emerging educational technologies; it also encompasses the responsibility of providing future generations with high-quality learning opportunities by embracing the vision of the founder of our Republic, Ghazi Mustafa Kemal Atatürk, who placed reason, science, and contemporary education at the center of societal progress.

On this occasion, I would like to respectfully commemorate and express my gratitude to our esteemed colleague, Prof. Dr. Erdinç Çakıroğlu, who played a pioneering role in establishing STEM education on an institutional foundation in our country and whose contributions were instrumental in the establishment and development of our Center. The progress achieved by BILTEMM today has been shaped by the dedicated efforts of academics, researchers, administrative staff, and stakeholders who have contributed to the Center throughout its history. I would also like to extend my sincere appreciation to the METU administration for its continued support; to the relevant units of our University, especially our Rector, Prof. Dr. Ahmet Yozgatlıgil; and to all faculty members and staff, particularly the Dean of the METU Faculty of Education, Prof. Dr. M. Levent İnce.

Throughout 2025, BILTEMM conducted a wide range of activities in the areas of teacher professional development, digital transformation, artificial intelligence, virtual reality, data science, biotechnology education, gamification, early childhood STEM education, and experiential learning. The seminars, workshops, projects, academic publications, conference presentations, consultancy services, and collaborative initiatives carried out during the year once again demonstrated that BILTEMM is not only a practice-oriented center but also an interdisciplinary research and impact center that contributes to the development, implementation, and dissemination of innovative approaches in education.

Projects and collaborations such as the Digital Teachers Project, the Amgen Biotechnology Experience, the DataSETUP Project, the partnership with LEGO Education, and ongoing initiatives with various institutions -particularly the Ministry of National Education- have further strengthened the Center's national and international impact. METU's strong scientific heritage, interdisciplinary culture, and commitment to social responsibility continue to guide all activities undertaken by BILTEMM.

Despite limited resources, the dedication and commitment demonstrated in these efforts reveal the Center's strong potential and its capacity to reach broader audiences in the field of education. In the coming years, BILTEMM aims to further strengthen its research, practice, and community engagement dimensions and continue contributing to high-quality, inclusive, and innovative STEM education.

I would like to express my sincere gratitude to our Center staff, members of the Executive Board, the METU Faculty of Education, all collaborating institutions and stakeholders, and the distinguished academics, teachers, pre-service teachers, students, and participants who contributed to and took part in our activities. Their dedication and support were instrumental in the successful implementation and completion of the Center's activities throughout 2025.

Sincerely,

Assoc. Prof. Dr. Gökür Kaplan
METU BILTEMM Director

EXECUTIVE SUMMARY

The year 2025 marked a period in which BILTEMM continued to visibly fulfill its missions in education, research, and community engagement while expanding its collaborations with national and international stakeholders. In addition to its ongoing work in STEM/STEAM education, the Center carried out activities in the areas of artificial intelligence, virtual reality, data science, biotechnology education, gamification, and teacher professional development.

During the year, BILTEMM reported 18 meetings, 14 seminars/panels/workshops, 3 active projects, 10 training workshops, 4 journal articles, 7 conference papers, 3 books/book chapters, 3 poster presentations, and 3 consultancy activities. A total of 2,740 participants were directly reached through the meetings, seminars, and workshops conducted throughout the year.

BILTEMM's activities in 2025 generated a multi-layered impact by engaging teachers, pre-service teachers, students, academics, science center professionals, and a wide range of institutional stakeholders. Major initiatives such as the Digital Teachers Project, the Amgen Biotechnology Experience, and the DataSETUP Project further strengthened the Center's role in teacher education, digital transformation, and data science education.

The table below summarizes the Center's main activity areas, scope, and the number of participants for 2025.

Activity Area	2025 Output / Scope
Meetings	18 meetings, 117 participants
Seminars / Panels / Workshops	14 events, 2,451 participants
Projects	3 active projects
Workshops	10 workshops, 172 participants
Academic Outputs	4 journal articles, 7 conference papers, 3 books/book chapters, 3 poster presentations
Consultancy	3 consultancy activities
Directly Reported Participants	2,740 individuals

1. GENERAL INFORMATION

This section presents information regarding the mission and vision of the METU STEM Center, its physical structure, administrative structure, and human resources.

1.1. Mission and Vision

As the METU STEM Center, our mission is defined as “carrying out education, research, and community service activities at both national and international levels - especially in the fields of science, technology, engineering, and mathematics education - in order to enhance and develop the knowledge and skills of individuals who are capable of coping with the rapidly changing conditions and problems of the 21st century.”

Our vision defined as “METU STEM Center will become one of the first application and research centers that come to mind in the field of science, technology, engineering and mathematics education, both nationally and internationally, primarily across the country, through the education, research, and community service activities it conducts.”

1.2. Information About BILTEMM Center

1.2.1. Physical Structure

The METU BILTEMM continues its activities in classroom EF-A 11 (BILTEMM LAB & LEGO Innovation Studio), located in Block A of METU Faculty of Education, which has been allocated to the Center with the contributions and support of the Dean’s Office of the METU Faculty of Education and the Department of Mathematics and Science Education of the METU Faculty of Education. In addition to this classroom, office space has been allocated for academic staff (research assistant) in office EF-A 39, also located in Block A of the METU Faculty of Education, with the contributions and support of the same units. For the use of administrative staff, office EF-A 13, located in Block A of the METU Faculty of Education, has been allocated to the Center on March 13, 2025, with the support of the Dean’s Office of the METU Faculty of Education.

1.2.2. BILTEMM LAB (LEGO Education Innovation Studio)

Established in collaboration with LEGO Education, BILTEMM LAB (Learn, Ask, Build) was inaugurated on May 16, 2019, with the participation of the METU Rector Prof. Dr. Mustafa

Verşan Kk, LEGO Education Head of East Markets (Middle East and Africa, Southeast Asia, Pacific and Korea) Villy Outzen, and LEGO Education Trkiye Partner and Teknokta General Manager Fatma Bezek.

BILTEMM LAB houses materials that can be used with students from preschool to high school level and, as described by LEGO Education, for a wide age range “from 9 to 99.” For individuals across this broad range, various LEGO Education products aimed at learning and developing different types of knowledge and skills are available. These products, along with their descriptions and applicable age ranges, are presented below:

PRESCHOOL	
Product	Description
1001 Games of Learning with the Odds and Ends Box	<ol style="list-style-type: none"> 1. Raising awareness of how various everyday odds and ends can enrich the learning journey 2. Developing holistic skills 3. Producing many games with limited materials 4. Supporting the development of imagination
LEGO Education STEAM Park Set	<ol style="list-style-type: none"> 1. Becoming familiar with STEAM concepts 2. Exploring how mechanisms work 3. Using engineering skills and redesigning 4. Developing cognitive, social and emotional skills

PRIMARY SCHOOL	
Product	Description
LEGO Education BricQ Motion Essential Set	<ol style="list-style-type: none"> 1. Reinforcing learning outcomes of core courses 2. Understanding force, motion and energy transformations 3. Exploring how simple machines work 4. Discovering engineering design processes 5. Developing problem solving skills
LEGO Education SPIKE Essential Set	<ol style="list-style-type: none"> 1. Developing problem solving and project creation skills 2. Developing robotic projects using Scratch 3. Enhancing computational thinking skills

	<ol style="list-style-type: none"> 4. Discovering engineering design processes 5. Reinforcing learning outcomes of core courses
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MIDDLE SCHOOL & HIGH SCHOOL	
Product	Description
LEGO Education BricQ Motion Prime Set	<ol style="list-style-type: none"> 1. Reinforcing learning outcomes of core courses 2. Understanding force, motion and energy transformations 3. Exploring how simple machines work 4. Discovering engineering design processes 5. Developing problem solving skills
LEGO Education SPIKE Prime Set	<ol style="list-style-type: none"> 1. Developing critical thinking skills 2. Gaining technology design skills 3. Exploring how simple machines work 4. Experiencing science concepts through hands-on applications 5. Developing robotics projects using Python

The age ranges/levels defined by LEGO Education can be extended to include preservice teachers and in-service teachers. For example, depending on the intended use and the design of the activity to be conducted, the STEAM Park Set, which is used for preschool age groups, can also be used with preservice teachers or teachers. Similarly, depending on the readiness levels of the participants, sets designed for middle school age groups may also be used with primary school students (or vice versa).

In addition to LEGO Education products, BILTEMM LAB is equipped with a three-dimensional (3D) printer. This printer enables the printing of materials that have been designed using 3D modeling. Moreover, non-technological materials, as well as recycled and stationery materials, are available for “unplugged” activities and STEM activities.

BILTEMM LAB has physical facilities suitable for group work, including one competition table used in tournaments such as FIRST LEGO League (FLL), seven tables, and twenty chairs. Its maximum capacity is 21, while its optimal capacity is 18.

1.2.3. Administrative Structure and Human Resources

The administrative structure of the METU STEM Center consists of the Center Director, the Deputy Director, and the Board of Directors. In order to indicate the human resources of the Center, this section also includes the research assistant and administrative staff who are not part of the administrative board.

At the METU STEM Center, the terms of office for the Director, Deputy Director, and the Board of the Directors are three years. The members of the Board of the Directors serve as academic staff in various departments of METU. One research assistant and one administrative staff member work full-time on behalf of the Center.

Center Director	Assoc. Prof. Dr. Göknur Kaplan, <i>Department of Computer Education and Instructional Technologies</i>
Deputy Director	Assoc. Prof. Dr. Engin Karahan, <i>Department of Mathematics and Science Education</i>
Executive Board Members	Prof. Dr. Akın Akdağ, <i>Department of Chemistry</i> Prof. Dr. Y. Eren Kalay, <i>Department of Metallurgical and Materials Engineering</i> Assoc. Prof. Dr. Nur Akkuş Çakır, <i>Department of Educational Sciences</i> Assoc. Prof. Dr. Sibel Kazak, <i>Department of Mathematics and Science Education</i>
Research Assistant	Res. Asst. Elçin Erbasan
Administrative Staff	Emrah Demirsoy

2. OBJECTIVES AND GOALS

This section presents information regarding the objectives and goals of the METU STEM Center.

2.1. Objective

The objective of the METU STEM Center is to (i) provide individuals from preschool to undergraduate level with the knowledge and skills that will enable them to cope with the changing conditions and problems of the twenty-first century in the fields of science, technology, engineering, and mathematics, (ii) conduct research and development activities in order to encourage students to orient toward these fields, and (iii) contribute to the training of qualified teachers.

2.2. Goal

The goals of the METU STEM Center are listed below:

1. To organize activities and programs aimed at the education and professional development of teachers, educators, and educational administrators from preschool to undergraduate level in the fields on which the Center focuses.
2. To conduct research and development studies aimed at the development of innovative approaches and products in science, mathematics, technology, and engineering education, and to provide researchers with resources and infrastructural support.
3. To develop massive open online courses for science, mathematics, technology, and engineering education.
4. To carry out product development studies for science, mathematics, technology, and engineering education and to obtain patents.
5. To develop projects and programs to provide high-quality educational opportunities for students who are disadvantaged in terms of gender, socioeconomic status, access to resources, and similar factors.
6. To support excellence in science, mathematics, technology, and engineering education and to ensure the sharing of national and international best practices.

3. ACTIVITIES

This section presents information regarding the activities carried out by the METU STEM Center throughout the year 2025.

3.1. Meeting

The meetings conducted in 2025 played an important role in strengthening internal coordination within the Center, maintaining communication with the METU Faculty of Education and departmental administrations, planning the involvement of students participating in the ISKUR Youth Program in Center activities, and fostering engagement with external stakeholders. Throughout the year, a total of 18 meetings were held, with 117 participants taking part in these meetings.

1. METU STEM Center Activities Conducted/Planned Meeting (Internal Meeting #1) – METU – January 13, 2025 – Participant(s): Assoc. Prof. Dr. Göknur Kaplan, Assoc. Prof. Dr. Engin Karahan, Res. Asst. Elçin Erbasan – 3 participants
2. METU STEM Center & METU Deanship of Faculty of Education Meeting – METU – January 15, 2025 – Participant(s): Assoc. Prof. Dr. Göknur Kaplan, Assoc. Prof. Dr. Engin Karahan, Res. Asst. Elçin Erbasan, Emrah Demirsoy – 5 participants
3. METU STEM Center & METU Faculty of Education Department Heads Meeting – METU – February 17, 2025 – Participant(s): Assoc. Prof. Dr. Göknur Kaplan, Assoc. Prof. Dr. Engin Karahan – 12 participants
4. METU STEM Center Activities Conducted/Planned Meeting (Internal Meeting #2) – METU – March 7, 2025 – Participant(s): Assoc. Prof. Dr. Göknur Kaplan, Assoc. Prof. Dr. Engin Karahan, Res. Asst. Elçin Erbasan, Emrah Demirsoy – 4 participants
5. METU STEM Center & ISKUR Youth Programme Students Introduction Meeting – METU – March 11, 2025 – Participant(s): Assoc. Prof. Dr. Göknur Kaplan, Assoc. Prof. Dr. Engin Karahan, Res. Asst. Elçin Erbasan, Emrah Demirsoy – 8 participants
6. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting – METU – April 21, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 5 participants
7. METU STEM Center & ISKUR Youth Programme Students Past Activities Evaluation Meeting #1 – METU – May 16, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 5 participants

8. METU STEM Center & ISKUR Youth Programme Students Past Activities Evaluation Meeting #2 – METU – May 29, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 5 participants
9. METU STEM Center & ISKUR Youth Programme Students Introduction Meeting – METU – November 7, 2025 – Participant(s): Assoc. Prof. Dr. Göknur Kaplan, Res. Asst. Elçin Erbasan, Emrah Demirsoy – 10 participants
10. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting #1 – METU – November 16, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 3 participants
11. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting #2 – METU – November 21, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 8 participants
12. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting #3 – METU – November 28, 2025 – Participant(s): Assoc. Prof. Dr. Göknur Kaplan, Res. Asst. Elçin Erbasan – 3 participants
13. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting #4 – METU – December 2, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 4 participants
14. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting #5 – METU – December 3, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 3 participants
15. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting #6 – METU – December 5, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 2 participants
16. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting #7 – METU – December 8, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 4 participants
17. Turkish Win Story Harvesting (The Informatics Association of Turkey (TBD)) – Bilkent Hane, Bilkent TEKMER – December 16, 2025 – Participant(s): Assoc. Prof. Dr. Meltem Eryilmaz, Assoc. Prof. Dr. Göknur Kaplan, Ceyda Süer – 30 participants
18. METU STEM Center & ISKUR Youth Programme Students Past and Upcoming Events Meeting #8 – METU – December 22, 2025 – Participant(s): Res. Asst. Elçin Erbasan – 3 participants

3.2. Seminar

The seminars, panels, and workshops organized in 2025 enhanced BILTEMM's visibility in the fields of STEM education, digital transformation, artificial intelligence, virtual reality, gamification, biotechnology education, and data science. These activities strengthened knowledge sharing and collaboration among teachers, academics, students, and other educational stakeholders. Throughout the year, a total of 14 events were conducted, reaching 2,451 participants.

1. Global Game Jam (GGJ ATOM) – Assoc. Prof. Dr. Göknur Kaplan – METU Teknokent CoZone – January 24-26, 2025 – 200 participants
2. STEM in Education and METU STEM Center (As part of Amgen ABE Program New Term Introduction Meeting) – Assoc. Prof. Dr. Göknur Kaplan – Online – February 6, 2025 – 30 participants
3. Digital Teachers and Educators (As part of 4th Türkiye Science and Technology Centers Summit (TUBITEM 2025)) – Assoc. Prof. Dr. Göknur Kaplan – Kocaeli – February 15, 2025 – 100 participants
4. “E-Öğrenme ve Yapay Zekâ” Panel (As part of EU Code Week Leading Teachers Meeting) – Assoc. Prof. Dr. Göknur Kaplan – ETKIM/METU Teknokent – February 18, 2025 – 30 participants
5. “VR'nin Eğitimde ve Geliştirilmesinde Akademinin Rolü” Panel (MoNE Research and Development and Ecosystem Department - As part of Virtual Reality and Innovation in Education Conference) – Assoc. Prof. Dr. Göknur Kaplan – ETKIM/METU Teknokent – February 26, 2025 – 100 participants
6. Virtual Reality Workshop (MoNE Research and Development and Ecosystem Department - As part of Virtual Reality and Innovation in Education Conference) – Assoc. Prof. Dr. Göknur Kaplan – ETKIM/METU Teknokent – February 26, 2025 – 50 participants
7. Innovative Educational Technologies in the Age of Artificial Intelligence (Within the scope of the Digital Teachers Project) – Prof. Dr. Kürşat Çağıltay – Online – March 16, 2025 – 600 participants
8. STEM Education Philosophy and Implementation Examples (Introductory Training for TUBITAK-Supported Science Center Employees - Birlikte İlk Adım) – Assoc. Prof. Dr. Engin Karahan – Şanlıurfa Bilim Merkezi – April 12-14, 2025 – 100 participants

9. Creative Organic Intelligence vs. Generative Artificial Intelligence (As part of the Digital Teachers Project) – Assoc. Prof. Dr. Göknur Kaplan – Online – April 20, 2025 – 500 participants
10. STEM, Creativity & New World Order – Assoc. Prof. Dr. Göknur Kaplan – METU Koleji – April 24, 2025 – 200 participants
11. Play-Friendly Schools and the Age of Technology (As part of the Digital Teachers Project) – Prof. Dr. Yavuz Samur – Online – May 3, 2025 – 300 participants
12. Learn, Transform with Science: Gamification Approaches in Biotechnology (As part of the Biotechnology Teacher Summit) – Assoc. Prof. Dr. Göknur Kaplan – Ankara Maya Anatolian and Science and Technology High School Campus – June 14, 2025 – 150 participants
13. Interrogating Messy Data: Exploring Mental Health in the Tech Industry through Data Science Practices (As part of DataSETUP Project/1st DataSETUP Multiplier Event: Bringing Data Science into Your Classroom) – University of Münster, Germany – October 2, 2025 – Participant(s): Assoc. Prof. Dr. Sibel Kazak – 10 participants
14. EU Code Week 2025: Mobile Magic with AI Twist – METU – October 21-24, 2025 – Participant(s): Assoc. Prof. Dr. Göknur Kaplan – 81 participants

3.3. Project

In 2025, three major projects were implemented or supported under the umbrella of BILTEMM. These initiatives strengthened the Center’s national and international impact in the areas of teacher professional development, biotechnology education, and data science education.

1. Amgen Biotechnology Experience Project

Through the Amgen Biotechnology Experience Project, BILTEMM contributed to strengthening biotechnology education at the secondary school level and supporting teachers in facilitating inquiry- and laboratory-based learning experiences. The project was implemented as an innovative educational model that promotes teachers’ professional development by providing curriculum resources, laboratory materials, and opportunities for hands-on learning.

2. Digital Teachers Project

Within the scope of the Digital Teachers Project, BILTEMM provided academic support for teachers’ professional development in the areas of digital literacy, digital

content development, artificial intelligence, assessment and evaluation, and educational technologies. The project aims to support teachers in engaging with the digital transformation process in a more informed, pedagogically grounded, and effective manner.

3. DataSETUP Project

Through the DataSETUP Project, BILTEMM became part of an international collaboration focused on advancing data science education within teacher education programs. The project contributes to the development of data literacy, data science competencies, and data-informed thinking skills in STEAM contexts among both pre-service teachers and teacher educators.

3.4. Collaboration

BILTEMM's activities in 2025 reached a broader sphere of influence through collaborations established with national and international stakeholders. These partnerships supported the Center's initiatives in teacher education, digital transformation, biotechnology education, and data science. In addition, ongoing collaborations with LEGO Education, the Ministry of National Education, and various educational institutions further enhanced BILTEMM's visibility in the areas of experiential learning, teacher education, and educational technologies.

The institutions and organizations with which BILTEMM collaborated during 2025 are listed below:

1. Within the scope of Amgen Biotechnology Experience Project:
 - a. Development Workshop
2. Within the Scope of Digital Teachers Project:
 - a. ING Türkiye
 - b. Habitat Association
3. Within the Scope of DataSETUP Project:
 - a. The University of Münster
 - b. The University of Paderborn
 - c. Mary Immaculate College
 - d. European University Cyprus
 - e. The National and Kapodistrian University of Athens

3.5. Workshop

The workshops conducted in 2025 enabled BILTEMM LAB to extend its capacity for experiential and hands-on learning to pre-service teachers and university students. Through LEGO Education and STEM-based workshops, participants engaged in practical learning experiences in the fields of early childhood education, science education, mathematics education, foreign language education, and instructional technologies. Throughout the year, a total of 10 workshops were organized, reaching 172 participants.

1. LEGO Education Workshop (As part of the PECE204-Mathematics Education in Early Childhood course, for TEDU FE students) – Res. Asst. Elçin Erbasan – METU – May 7, 2025 – 20 participants
2. LEGO Education Workshop (As part of the ECE500-Seminar in Early Childhood Education and ECE334-Digital Literacy for Pre-school Teachers courses, for METU FE students) – Res. Asst. Elçin Erbasan – METU – May 8, 2025 – 20 participants
3. LEGO Education Workshop (As part of the PECE204-Mathematics Education in Early Childhood course, for TEDU FE students) – Res. Asst. Elçin Erbasan – METU – May 14, 2025 – 20 participants
4. LEGO Education Workshop (As part of the ECE334-Digital Literacy for Pre-school Teachers course, for METU FE students) – Res. Asst. Elçin Erbasan – METU – May 8, 2025 – 20 participants
5. STEM Education Workshop (As part of the MSE482-Project in Mathematics and Science Education course, for METU FE students) – Res. Asst. Elçin Erbasan – METU – May 20, 2025 – 10 participants
6. LEGO Education Workshop (As part of the MSE482-Project in Mathematics and Science Education course, for METU FE students) – Res. Asst. Elçin Erbasan – METU – May 27, 2025 – 10 participants
7. LEGO Education Workshop (As part of the MSE329-Instructional Technology and Material Development course, for METU ESE department students) – Res. Asst. Elçin Erbasan – METU – December 10, 2025 – 22 participants
8. LEGO Education Workshop (As part of the CEIT319-Instructional Technology and Material Development course, for METU FLE department students) – Assoc. Prof. Dr. Gökür Kaplan – METU – December 16, 2025 – 20 participants

9. LEGO Education Workshop (As part of the CEIT319-Instructional Technology and Material Development course, for METU FLE department students) – Assoc. Prof. Dr. Gökür Kaplan – METU – December 17, 2025 – 10 participants
10. LEGO Education Workshop (As part of the CEIT319-Instructional Technology and Material Development course, for METU FLE department students) – Assoc. Prof. Dr. Gökür Kaplan – METU – December 18, 2025 – 20 participants

3.6. Article

Academic publications produced in 2025 with contributions from BILTEMM Executive Board members and researchers supported the Center’s research productivity in areas such as STEM education, mixed reality, entrepreneurship, mathematics education, and inclusion.

1. **Karahan, E.** (2025). Investigating the early years of STEM education reform in Türkiye from an equity standpoint. *The Urban Review*, 57(1), 51-71.
2. Akçay, A. O., Çil, O., & **Karahan, E.** (2025). Building with blocks to implement mathematical knowledge. *The Australian Primary Mathematics Classroom*, 30(1), 36–41.
3. Saraçlar, C., Akçay, A. O., & **Karahan, E.** (2025). Designing for entrepreneurship: STEM-based approaches in primary education. *Design and Technology Education*, 30(3), 72-99.
4. Piri, Z., **Kaplan, G.**, & Cagiltay, K. (2025). Enhancing Cognitive Fit: Exploring the Potential of Mixed Reality for Developing Mental Rotation Skills. *International Journal of Human-Computer Interaction*, 41(14), 8639–8654. <https://doi.org/10.1080/10447318.2024.2413291>

3.7. Conference Paper

Papers presented at national and international conferences contributed to the dissemination of BILTEMM’s research findings and practical experiences within academic communities.

1. **Erbasan, E.** & Işıksal-Bostan, M. Exploring computational thinking in STEM education: Moonbase activity. (2025). In Bosch, M., Bolondi, G., Carreira, S., Spagnolo, C., & Gaidoschik, M. (Eds.), *Proceedings of the Fourteenth Congress of the European Society for Research in Mathematics Education (CERME14)*, (pp. 4215-4222). Free University of Bozen-Bolzano and ERME.

2. Podworny, S., Birk, L., **Kazak, S.**, & Leavy, A. (2025). Preservice teachers' exploration of multivariate data based on personal interests. In Birk, L., Loth, G., Jotzo, L., Binder, K., & Frischemeier, D. (Eds.), *Statistics and Data Science Education in STEAM. Proceedings of the Satellite Conference of the International Association for Statistical Education (IASE)*, September 30-October 2, 2025, Münster, Germany.
3. Akar, H., **Karahan, E.**, Çetinkaya, Z., Bük, M. E., Çerşil, A., & **Erbasan, E.**, (2025). *Creating Effective Learning Spaces through Design-based Learning Interdisciplinary Collaboration in Higher Education*. EDU Congress 2025, Antalya, Türkiye.
4. Aykut, C., & **Karahan, E.** (2025). *Bridging Science and Multimedia: How Pre-Service Teachers Represent Science in Digital Artifacts*. The 16th Conference of The European Science Education Research Association (ESERA 2025). Kobenhavn, Denmark.
5. Uygun, C. B., Gezer, I., & **Karahan, E.** (2025). *The Interplay Between the Planned and Enacted Curricula in the Context of Laboratory Work*. The 16th Conference of the European Science Education Research Association (ESERA). Kobenhavn, Denmark
6. **Kaplan, G.**, Tüker, Ç., Çelik, B, Çağiltay, K. (2025). *Beyond Headsets: A Pragmatic Framework for K-12 VR Adoption-Bridging Pedagogy, Access, and Institutional Readiness*. 4th Eurasian Conference On Human-Computer Interaction (HCI-E 2025) Conference, December 5-6, Baku, Azerbaijan.
7. **Kaplan, G.**, Tüker, Ç., Çelik, B, Çağiltay, K. (2025). *Virtual Reality Editors Used in K-12 Learning Environments: A Comparison Study*. 18th ICITS Conference, September, 18-19, Ankara, Türkiye.

3.8. Book/Book Chapter

Books and book chapters published by Center members demonstrate their theoretical and practical contributions to diverse fields, including STEM education, artificial intelligence, engineering design, and educational journalism.

1. **Karahan, E.** (2025). Empowering Refugee Students Through Engineering Design-Based Learning in STEM Education. In M. S. Semerciöglu & A. O. Akçay (Eds.), *Foundational Education of Primary-Level Refugee Students* (pp.275-293), Zürich: Springer Nature.
2. Namdar, B., & **Karahan, E.** (2025). Sosyobilimsel Konularda Yapay Zekâ. In B. Sezginsoy Şeker, Ü. İ. Onbaşılı (Eds.), *Dijital Çağın Öğretmenleri* (pp. 33-47), Ankara: Nobel Yayın Dağıtım.

3. **Karahan, E.** (2025). Eğitim ve Eğitimle İlgili Temel Kavramlar. In A. F. Paksoy & H. Kahveci (Eds.), *Teori ve Pratikte Eğitim Haberciliği* (pp.1-20), Ankara: Literatür Yayıncılık.

3.9. Poster Presentation

Poster presentations increased the visibility of studies conducted in the areas of data science education, performance improvement, and design-oriented solution development across various academic and professional platforms.

1. Podworny, S., **Kazak, S.**, & Leavy, A. (2025). Data science modules for preservice teacher education. The Fourteenth Congress of the European Society for Research in Mathematics Education (CERME-14), the Free University of Bozen-Bolzano, Italy. 4-8 February 2025. <https://www.cerme14.it/> – 300 participants
2. A Human Centered Solution for the Commercial Refrigeration Sector – 2025 ISPI HPT Case Competition Presentation – CoolDAMB Team – Danışman: Assoc. Prof. Dr. Gökür Kaplan – Takım: Doğan Tosun, Ahmet Faruk Öz, Bilge Uzun, Nida Melis İşleyen – The Performance Improvement Conference – 13-17 Nisan 2025 – Online (<https://ispi.org/event/2025PIConference>) – 50 participants
3. Oz, A. F., Uzun B., Tosun, D., Isleyen, N. M., **Kaplan G.** (2025) A Design-Centered Strategy For Technician Shortage And Training Gaps. The 2025 ISPI Annual PI Conference, ISPI University Case Study Competition

3.10. Consultancy

Consultancy activities reflect BILTEMM's expertise and contributions to institutions in the areas of educational technologies, teacher education, digital content development, and accessibility and usability testing.

1. Development Workshop
2. MoNe YEGITEK – Educational e-content editing
3. Habitat Association– Experiment

4. ASSESSMENT OF INSTITUTIONAL CAPACITY

This section presents information regarding the general assessment of the METU STEM Center by addressing its strengths and weaknesses.

4.1. Strengths

1. Operating as an application and research center in the field of education under the well-known and respectable name of METU, which is an important brand of Türkiye.
2. Carrying out education, research, and community service activities in the fields of STEAM education and approaches simultaneously with developments abroad.
3. Becoming one of the pioneering institutions in Türkiye in these fields by starting its operations in 2015, at a time when STEAM education and approaches were on the global agenda.
4. Having an institutional culture despite limited human resources (one actively working director, one deputy director, one research assistant, and one administrative staff member).
5. Having highly motivated, determined, and hardworking staff to achieve the Center's goals, realize its potential, and carry out education, research, and community service activities.
6. Establishing collaborations with competent institutions, organizations, and individuals at national and international levels.
 - a. BILTEMM LAB is one of the limited numbers of LEGO Education Innovation Studios in Türkiye. The lesson plans designed by LEGO Education have been translated into Turkish by the Center staff, and learning outcome alignment has been conducted with the curricula used in our country. Collaboration with LEGO Education continues.
 - b. In collaboration with the Amgen Foundation and Kalkınma Atölyesi, the Amgen Biotechnology Experience, an innovative educational program that provides professional development activities, curriculum materials, equipment, and supplies to teachers working in secondary education schools, has been designed.
 - c. Primary and secondary school teachers were able to step into the digitalizing world, gain digital literacy skills they can use in face-to-face and distance education and contribute in Türkiye's digital transformation process with

collaborations made in Digital Teachers Project.

- d. Collaborations with Ministry of National Education especially about teacher training are continued.

4.2. Areas for Improvement (Weaknesses)

1. The Center continues to require a permanent meeting room as well as a larger classroom space for BILTEMM LAB activities.
2. Additional personnel are needed to expand the reach of the Center's education, research, and community engagement activities and to serve a larger number of students, pre-service teachers, and in-service teachers.
3. The visibility and dissemination of the Center's activities need to be further strengthened. The increased recognition achieved within METU -particularly within the Faculty of Education- and among external stakeholders prior to the COVID-19 pandemic declined during the period of remote education, highlighting the need for more effective communication and outreach efforts.

4.3. Assessment

The METU BILTEMM Center possesses significant potential in the areas of education, research, and community engagement through its strong academic expertise, interdisciplinary culture, experiential learning infrastructure, and extensive stakeholder network. Through its activities in contemporary fields such as STEM/STEAM education, teacher professional development, digital transformation, artificial intelligence, data science, virtual and augmented reality, and experiential learning, the Center has established itself as a value-generating institution both within METU and at the national level.

The workshops, seminars, projects, academic outputs, consultancy activities, and collaborations carried out in 2025 demonstrate that BILTEMM is a center capable of reaching diverse target audiences, supporting interdisciplinary work, and contributing to the dissemination of innovative educational practices. Preserving and further strengthening the Center's existing strengths is essential for ensuring the sustainability of its activities and enhancing their long-term impact.

At the same time, the growing diversity of activities and the expanding network of collaborations highlight the need to strengthen several areas for development, particularly physical infrastructure, human resources, and institutional visibility. Improvements in these

areas will enable BILTEMM to utilize its existing potential more effectively, reach a larger number of students, pre-service teachers, teachers, and educational stakeholders, and make an even stronger contribution to METU's mission of serving society.

5. RECOMMENDATIONS AND MEASURES

This section presents information regarding the recommendations and measures related to the activities of the METU STEM Center.

The METU BILTEMM Center closely monitors ongoing developments and transformation processes across all levels of education and seeks to address emerging needs in areas such as STEM education, digital transformation, artificial intelligence, data science, virtual and augmented reality, and teacher professional development through its education, research, and community engagement activities. In periods characterized by educational reform and innovation, although the context may be dynamic and unpredictable, BILTEMM is well positioned to transform uncertainty into opportunity and to serve as an active contributor and leading actor in shaping new educational directions.

To effectively and sustainably capitalize on these opportunities, it is important to strengthen the Center's physical infrastructure and human resource capacity. In this regard, the allocation of an additional classroom to the Center by the METU Faculty of Education Dean's Office for a three-year period has provided significant support for BILTEMM's planning and operational capacity. This allocation is expected to facilitate the more effective implementation of workshops, meetings, training programs, project development activities, and collaborative initiatives with stakeholders.

Nevertheless, considering the Center's growing national and international collaboration potential, expanding range of activities, and increasing target audience, the need to further strengthen its physical facilities and personnel capacity remains. Supporting the existing workforce is essential to ensure the effective and high-quality management of education, research, project implementation, stakeholder engagement, event organization, academic production, and reporting processes.

Accordingly, it is recommended that the spatial support provided to BILTEMM be sustained and utilized effectively; that the Center's academic, administrative, and technical staff capacity be strengthened; and that existing collaborations be deepened while new national and international partnerships are developed. Preserving the Center's strengths and addressing areas for improvement will enable BILTEMM to reach broader audiences, deliver higher-quality

activities, and further enhance its national and international impact in STEM education, in line with METU's scientific excellence and mission of social responsibility.