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Research Article

Institutionalizing Undergraduate Research: A Policy Roadmap for Turkish Research Universities

Lisans Öğrencisi Araştırmalarının Kurumsallaştırılması: Türkiye'deki Araştırma Üniversiteleri İçin Bir Politika Yol Haritası

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Abstract: This study provides a strategic roadmap for the systematic institutionalization of undergraduate research experiences (URE) in Türkiye's research universities. Aiming to bridge the gap between national policy goals and fragmented practices, the research seeks to transform the current structure into a coherent, policy-accountable research ecosystem. The study employs a scoping review of 76 national publications spanning 1994–2025 and a descriptive content analysis of seven key higher education policy documents. Findings reveal that the current literature is heavily concentrated in Educational Sciences (50 of the 76 studies), while STEM fields are significantly underrepresented; furthermore, only eight of the 76 studies meet the international definition of authentic undergraduate research participation, indicating a critical conceptual and structural gap. Analysis of seven key policy documents reveals that while national frameworks increasingly reference undergraduate research in aspirational terms, none includes operationalizable performance indicators for URE participation – reflecting the empirical gap identified in the literature. Existing practices remain largely extracurricular and grant dependent. To overcome these structural barriers, a three-tiered "IUR-Türkiye" implementation model encompassing policy, institutional, and curricular levels is proposed. The model recommends requiring measurable metrics at the Council of Higher Education (YÖK) level, establishing centralized Undergraduate Research Offices, and embedding Course-Based Undergraduate Research Experiences (CURE) into the curriculum. Furthermore, the formal recognition of faculty mentorship within academic promotion processes is emphasized as a strategic requirement for a sustainable research culture.

Keywords: undergraduate research, research universities, Türkiye, higher education policy, course-based undergraduate research experiences (CURE).

Özet: Bu çalışma, Türkiye'deki araştırma üniversitelerinde lisans araştırma deneyimlerinin (LAD) sistematik olarak kurumsallaşması için stratejik bir yol haritası sunmaktadır. Ulusal politika hedefleri ile parçalı uygulamalar arasındaki boşluğu kapatmayı amaçlayan bu araştırma, mevcut yapıyı tutarlı ve politikalarla uyumlu bir araştırma ekosistemine dönüştürmeyi hedeflemektedir. Çalışmada, 1994–2025 yıllarını kapsayan 76 ulusal yayın kapsamlı olarak incelenmiş ve yedi temel yükseköğretim politika belgesinin betimsel içerik analizi gerçekleştirilmiştir. Bulgular, mevcut alanyazının büyük ölçüde Eğitim Bilimleri (76 çalışmadan 50'si) alanında yoğunlaştığını, STEM alanlarının ise önemli ölçüde yetersiz temsil edildiğini ortaya koymaktadır. 76 çalışmadan yalnızca sekizi lisans araştırması deneyiminin uluslararası tanımını karşılamakta olup, bu durum önemli bir kavramsal ve yapısal boşluğa işaret etmektedir. Yedi temel politika belgesinin analizi ise ulusal çerçevelerin lisans araştırmalarına giderek daha fazla atıfta bulunmasına rağmen, hiçbirinin LAD katılımı için uygulanabilir performans göstergeleri içermediğini göstermektedir. Bu durum, alanyazında tespit edilen ampirik boşluğu yansıtmakta ve pekiştirmektedir. Mevcut LAD uygulamaları, büyük ölçüde eğitim programı dışı ve hibe desteklerine bağımlı kalmaktadır. Bu yapısal engelleri aşmak için; politika, kurum ve eğitim programı düzeylerini kapsayan üç aşamalı bir "IUR-Türkiye" uygulama modeli önerilmektedir. Model; Yükseköğretim Kurulu (YÖK) düzeyinde ölçülebilir göstergelerin zorunlu kılınmasını, merkezi Lisans Araştırma Ofislerinin kurulmasını ve Ders Tabanlı Lisans Araştırma Deneyimlerinin (D-LAD) eğitim programına dahil edilmesini önermektedir. Ayrıca, sürdürülebilir bir araştırma kültürü için akademik yükselme süreçlerinde öğretim üyelerinin mentorluk çalışmalarının resmi olarak tanınması stratejik bir gereklilik olarak vurgulanmaktadır.

Anahtar Kelimeler: lisans öğrencisi araştırmaları, araştırma üniversiteleri, Türkiye, yükseköğretim politikası, ders temelli lisans araştırmaları.

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1. Introduction

In research-intensive universities, undergraduate research experiences (UREs) function as both pedagogical tools and institutional strategies. By connecting student learning with faculty scholarship, UREs build institutional research capacity, encourage collaboration, and foster research-oriented environments (Healey & Jenkins, 2009; Laursen et al., 2010). Hordern (2013) describes this as institutional connectivity, linking teaching, research, and community engagement. Furthermore, integrating UREs into long-term strategy strengthens institutional coherence, visibility, and funding competitiveness (Malachowski et al., 2015), while renewing faculty motivation and expanding professional networks (Baker et al., 2022).

Globally, universities have adopted diverse URE models including course-based research experiences (CUREs), research apprenticeships, competitive research scholarships, and student-led projects. In the United States, programs inspired by the Boyer Commission on Educating Undergraduates in the Research University (1998) and the Council on Undergraduate Research (n.d.) focus on structural frameworks. Similarly, the European model, shaped by the Bologna Process, emphasizes curriculum reform through inquiry-based learning, positioning active inquiry as central to educational quality and employability (European Higher Education Area, 2009, 2024; Gaebel et al., 2024).

Beyond pedagogy, undergraduate research serves as a vital policy mechanism for national innovation. Studies from Qatar and India indicate that it builds doctoral human capital and links higher education to innovation systems (Ahmad et al., 2023; Sengupta, 2019). Similarly, integrating research into policy enhances productivity and sustainability in Nigeria and Puerto Rico (Asikhia, 2013; Godreau et al., 2015), while evidence from New Zealand confirms its contribution to long-term research capacity (Spronken-Smith et al., 2014).

Undergraduate research also represents a concrete mechanism for advancing equity in higher education. Sustainable Development Goal 4.3, which calls for equal access to affordable and quality technical, vocational, and higher education (United Nations, 2024), is not fulfilled by enrollment alone; it requires that students across disciplines, socioeconomic backgrounds, and institutional types have meaningful access to the knowledge-creation activities that define research universities. Empirical evidence confirms that well-designed models, specifically CUREs and mentored projects, reduce participation gaps and broaden engagement among underrepresented groups (Bangera & Brownell, 2014; Haeger et al., 2020). Thus, URE institutionalization is not merely a pedagogical or research-capacity issue; it is a prerequisite for ensuring that research universities fulfill the equity dimension of their public mission.

For Türkiye, which hosts over 3.5 million undergraduates (Yükseköğretim Kurulu, 2025), this gap between global URE models and local institutional practice is both structural and empirical. Structurally, while mechanisms such as TÜBİTAK 2209-A/B grants and institutional BAP funding exist, they operate in isolation; competitive, faculty-led, and postgraduate-focused, rather than within a coordinated, undergraduate-inclusive architecture. This fragmentation directly contradicts the research excellence and doctoral capacity targets set by the Twelfth Development Plan (2024–2028) (Presidency of the Republic of Türkiye, 2023) and Yükseköğretim Kurulu's (YÖK) Research University Initiative (Yükseköğretim Kurulu, 2019). Empirically, the national scholarly literature on undergraduate research is overwhelmingly concentrated in attitudinal constructs such as research anxiety, self-efficacy, and course perceptions (Bilasa & Taşpınar, 2019; Kart & Gelbal, 2014), rather than in structured participation in knowledge creation. A scoping review of 76 national publications spanning 1994–2025, conducted as part of the present study, found that only eight distinct research projects meet the international definition of authentic undergraduate research participation, a finding that signals not only a quantitative scarcity but a conceptual displacement: undergraduate research in Türkiye is framed as an attitudinal outcome rather than a structural and curricular practice.

Against this dual gap, the present study pursues two aims: (1) to map the scope and character of the existing national URE literature and key higher education policy documents through a scoping review and descriptive content analysis; and (2) to propose a model for the systematic institutionalization of undergraduate research at Turkish research universities. Drawing on international scholarship that positions UREs at the intersection of pedagogy and policy (Hensel & Blessinger, 2020; Healey & Jenkins, 2009; Linn et al., 2015), the study argues that the structural and empirical gaps identified above cannot be addressed through isolated grant programs alone, but require coordinated intervention at the policy, institutional, and curricular levels simultaneously.

The paper is organized as follows: Section 2 establishes the conceptual framework, reviewing four typological approaches to undergraduate research and their implications for the Turkish context. Section 3 describes

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the methodology, including the scoping review protocol and the policy document analysis. Section 4 maps the national URE landscape; the disciplinary distribution of the literature, the policy architecture, and four pioneering institutional programs. Section 5 presents the IUR-Türkiye model and its three implementation tiers. Section 6 discusses the conditions for successful implementation, the comparative implications for similar systems, and the study's limitations, then concludes with a concrete policy call and directions for future research.

2. Undergraduate Research: Conceptual Framework

2.1. Historical Foundations of the Teaching–Research Nexus

In the nineteenth century, two competing visions of the university emerged. Humboldt's Prussian model held that research and teaching were inseparable, uniting students and faculty in the joint production of knowledge (Ash, 2006; Ben-David, 1992). Newman's (1852) Oxford model insisted instead that the university's primary duty was intellectual formation through teaching, and that research belonged to academies rather than undergraduate classrooms. This tension was never resolved but institutionalized as most modern research universities operate with a de facto Newmanian undergraduate experience, lecture-based and transmission-oriented, inside a formally Humboldtian identity. The result is what Boyer (1998) named as structural schizophrenia, where universities claim the research mission as their core identity while routinely excluding undergraduates from it. This tension persists in the contemporary knowledge society, where the academic role is increasingly stretched between competing teaching and research demands (Scott, 2006), and where a positive teaching-research link requires deliberate institutional design rather than emerging spontaneously (Elton, 2001).

The Boyer Commission's (1998) intervention was significant because it reframed the exclusion of undergraduates from research as a policy failure rather than a natural condition, shifting the debate from pedagogy to accountability. This is directly relevant to Türkiye as the empirical gap documented in Section 4.3 reflects insufficient accountability rather than insufficient awareness, since no policy instrument currently requires Turkish research universities to involve undergraduates in knowledge creation.

Kuh (2008) operationalized this vision within higher education's quality assurance infrastructure. By defining undergraduate research as a High-Impact Practice (HIP) with documented effects on retention, critical thinking, and graduate preparedness, he gave institutional research offices and accreditation bodies an evidence-based rationale for mandating what Boyer had recommended. Its translation into European policy through the European Higher Education Area's (EHEA) emphasis on research-based learning (European Higher Education Area, 2009) and the UK's Research Excellence Framework (2014) reward structure shows that the teaching-research nexus has shifted from a philosophical ideal to a measurable institutional obligation. The IUR-Türkiye framework attempts a similar translation within the YÖK accreditation and performance evaluation architecture.

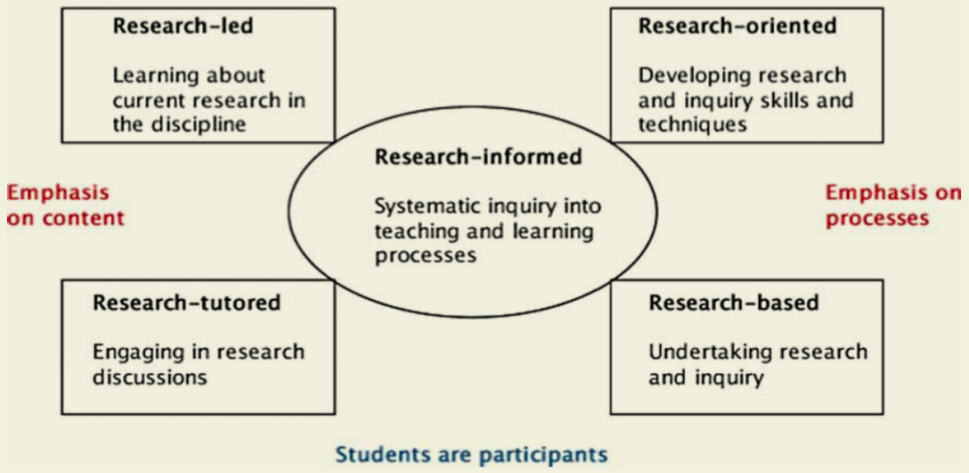


Figure 1. Dimensions of Research in Undergraduate Learning (DRUL). Adapted from Ozay (2012).

2.2. Conceptual Models of Undergraduate Research

Several frameworks articulate the integration of teaching and research. Griffiths (2004) introduced a foundational typology distinguishing research-led (learning current research), research-oriented (learning methods), research-based (doing inquiry), and research-informed (pedagogical reflection) approaches, emphasizing that students should be active participants in knowledge creation. Healey (2005) extended this into a two-dimensional model linking research content and process with teacher- and student-focused orientations, identifying four modes (research-led, research-oriented, research-tutored, and research-based) by visualizing a continuum where students progress from passive reception to active inquiry. Levy and Petrulis (2012) refined this through an inquiry-based framework distinguishing staff-led from student-led inquiry and the exploration of existing knowledge from the generation of new knowledge, mapping four quadrants (identifying, pursuing, producing, and authoring) that trace the move from guided exploration to independent authorship. Finally, Ozay (2012) proposed the Dimensions of Research in Undergraduate Learning (DRUL) model (▶**Figure 1**), which places research-informed practice at the center and treats the surrounding dimensions as a progression from learning about research to engaging in it.

Ozay's (2012) framework provides a context-sensitive template for transitioning Türkiye's fragmented, extracurricular URE system (e.g., BAP) into a cohesive ecosystem. Given the dual challenge of massive enrollment and a postgraduate-focused research culture, prioritizing research-informed practice as a central, scalable dimension is critical. Unlike general continuums, this model requires that faculty use research to enhance pedagogy, driving a system-wide cultural shift. This establishes the intellectual infrastructure necessary to sustain scalable models like CUREs and integrates research-based inquiry as a core curricular practice, rather than relying solely on competitive, faculty-centric grants.

Taken together, these four frameworks represent a cumulative development rather than competing alternatives (see ▶**Table 1**). Griffiths (2004) establishes the foundational taxonomy by identifying the modes through which students can engage with research but remains primarily descriptive. Healey (2005) adds a pedagogical dimension by introducing the tension between teacher-focused and student-focused orientations, making the framework actionable for curriculum design. Levy and Petrulis (2012) refine the student agency dimension, giving a more granular account of how students move from consumers to producers of knowledge. Ozay's (2012) DRUL model synthesizes these contributions by repositioning research-informed practice, rather than research-based inquiry, as the universal entry point, applicable regardless of institutional scale or disciplinary context. Critically, while the first three frameworks each presuppose conditions (small cohorts, seminar-based pedagogy, advanced student preparation) that are difficult to meet in Türkiye's mass higher education context, the DRUL model's emphasis on research-informed pedagogy as a faculty obligation provides a scalable and institutionally embeddable starting point. The IUR-Türkiye framework builds on this synthesis by operationalizing each typological tier, from research-informed through

Table 1. Comparative Analysis of URE Typological Frameworks

Dimension	Griffiths (2004)	Healey (2005)	Levy & Petrulis (2012)	Ozay / DRUL (2012)
Student Role	Passive recipient → active participant; progression from learning about research to doing research	Continuum from student as audience to student as participant; role depends on faculty orientation	Student moves from guided exploration (staff-led) to independent authorship (student-led)	Student progresses through four surrounding dimensions toward research-engaged practice; all roles can coexist
Faculty Role	Designs the degree to which students access research knowledge and practice	Determines orientation (teacher-focused vs. student-focused) and content emphasis (process vs. results)	Positions students along staff-led/student-led axis; scaffolds the transition to authorship	Embeds research into pedagogy as a professional obligation; research-informed teaching is the default, not the exception
Scalability	Moderate: taxonomy is descriptive, not prescriptive; does not specify implementation pathways for large cohorts	Moderate: two-dimensional visualization aids curriculum mapping but assumes relatively small, seminar-style settings	Low–moderate: authorship quadrant presupposes advanced students; difficult to operationalize at system scale	High: research-informed dimension is universally applicable regardless of class size; provides scalable entry point before advancing to research-based tiers
Applicability to Türkiye	Useful as a diagnostic lens for identifying current position in the Turkish system (predominantly research-led); limited action guidance	Supports YÖK curriculum reform framing; compatible with Bologna-aligned course design	Better suited to honors-track or advanced elective contexts; less applicable to mass undergraduate enrollment	Best fit for Türkiye: research-informed practice can be embedded across all disciplines and enrollment scales; compatible with BAP-funded faculty research and CURE integration

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research-based, as distinct policy levers corresponding to the model's three implementation levels.

2.3. International Policy Frameworks Supporting Undergraduate Research

The conceptual frameworks in Section 2.2 have shaped higher education policy differently across governance contexts. What is instructive for Türkiye is not that URE has become a global priority, but how different systems have transformed that priority into institutional obligation, and which transformation mechanisms are available within Türkiye's governance architecture.

The United States model works mainly through accreditation pressure and funding incentives. The Boyer Commission (1998) and Council on Undergraduate Research (n.d.) established the normative case, and Kuh's (2008) High-Impact Practices framework then gave accreditation bodies and assessment offices a measurable vocabulary for URE participation. As a result, URE has become a standard reporting category in U.S. accreditation: not mandated by federal law but effectively required by reputational and funding competition. This bottom-up normalization through accreditation infrastructure is the closest analogue to what IUR-Türkiye proposes for the YÖK-YÖKAK quality assurance system.

The United Kingdom model works through research evaluation. The Research Excellence Framework (REF, 2014) does not directly assess URE, but by making research impact (including pedagogical impact) a funding-consequential activity, it creates indirect incentives to embed research into undergraduate curricula. The Higher Education Academy's Student as Producer initiative (Neary et al., 2014) turned this incentive into a curriculum design framework. The key insight for Türkiye is that URE can be institutionalized as a by-product of research evaluation reform, a pathway that YÖK's academic incentive regulation already partly opens.

The EHEA represents a third mechanism with standardization through learning outcomes frameworks. The Bologna Process' emphasis on research-based learning as a third-cycle descriptor (European Higher Education Area, 2009) has gradually repositioned URE from enrichment to expectation within European quality assurance frameworks. Gaebel et al. (2024) confirm that European institutions increasingly treat student research participation as a quality indicator rather than an optional extra. Türkiye is a Bologna signatory, and YÖKAK's accreditation criteria are partly Bologna-derived, creating a direct pathway for embedding URE participation requirements within existing accreditation standards without new legislation.

Together, these frameworks show that URE institutionalization has followed three pathways: accreditation-driven normalization (U.S.), research-evaluation-driven incentives (UK), and learning-outcomes-driven standardization (EHEA). Türkiye's governance architecture, with YÖK's centralized regulatory power, YÖKAK's accreditation mandate, and the faculty incentive structure (Akademik Teşvik Yönetmeliği), contains equivalents of all three. The question is not whether the tools exist, but whether they will be deliberately aligned around URE participation as a policy objective, which is precisely what IUR-Türkiye proposes.

2.4. Empirical Evidence and Outcomes Of Undergraduate Research

Empirical research consistently validates the policy emphasis on undergraduate research. In this study, however, this evidence is not merely contextual background; it serves an analytical function. The outcomes documented in the international literature define what authentic URE participation produces; the scoping review in Section 4.3 documents how far Turkish higher education falls short of them. Read together, the two reveal that the Turkish gap is not one of knowledge, since the benefits of URE are well understood globally, but of institutional design and policy will.

2.4.1. Student Benefits and Academic Growth

Research engagement is consistently linked to gains in critical thinking, problem-solving, and analytical reasoning (Adedokun et al., 2014; Kardash, 2000; Lopatto, 2004, 2007; Seymour et al., 2004). Participants demonstrate improved communication, teamwork, and disciplinary understanding, alongside increased academic confidence and a sense of belonging (Auchincloss et al., 2014; Hunter et al., 2007; Laursen et al., 2010; Thiry & Laursen, 2009). These benefits reflect Astin's (1984) Theory of Student Involvement, which suggests that student investment of time and energy is central to growth. As a high-impact practice, undergraduate research fosters academic identity and strengthens retention and graduate preparedness (Borrego et al., 2018; Eagan et al., 2013; Hathaway et al., 2002). Critically, these outcomes depend on structured participation in authentic inquiry.

2.4.2. Faculty and Institutional Impact

For faculty, mentoring undergraduate researchers drives professional renewal, disciplinary engagement, revitalized teaching, and new scholarship avenues (Vandermaas-Peeler, 2016; Baker et al., 2022; National Academies of Sciences Engineering and Medicine, 2017). Willison (2012) indicates that integrating research skills into curricula clarifies pedagogy and reshapes faculty understanding of their own research, creating a feedback loop between teaching and research.

Institutions benefit from stronger teaching-research integration, interdisciplinary initiatives, and greater visibility through student outputs (Laursen et al., 2010; Brew, 2013; Hordern, 2013). These benefits, however, depend on incentive structures that make URE mentorship visible and rewarded. In Türkiye, YÖK's Akademik Teşvik Yönetmeliği rewards publications and projects of faculty but has no provision for undergraduate mentorship, a gap the IUR-Türkiye framework addresses in Section 5.3.1.2.

2.4.3. Global Reach and Diverse Contexts

In emerging systems like India, Qatar, and Nigeria, UREs function as policy instruments for doctoral and institutional capacity building (Sengupta, 2019; Ahmad et al., 2023; Asikhia, 2013), and evidence from New Zealand demonstrates that curricular embedding fosters sustainable, collaborative ecosystems (Spronken-Smith et al., 2013, 2014). What is significant for Türkiye is that in each case, URE expansion required not only institutional willingness but a deliberate policy trigger, such as a funding condition, accreditation requirement, or national reform mandate that made the status quo costly. The absence of such a trigger in Türkiye is what the governance gap analysis in Section 4.1 documents.

2.4.4. Equity and Inclusion

Inclusive program design promotes equity in research participation: CUREs and early exposure models reduce achievement gaps and broaden participation for underrepresented groups (Bangera & Brownell, 2014; Haeger et al., 2020). This is especially relevant in Türkiye, where the existing URE ecosystem (TÜBİTAK scholarships, PURE, KUSRP) is structurally selective: competitive, faculty-dependent, and concentrated in a few institutions. CUREs are the only delivery model shown to reach large, diverse cohorts without prior research preparation, which is why they form the base tier of the IUR-Türkiye pipeline proposed in Section 5.3.1.

Together, this evidence establishes three anchors for the analysis that follows, each naming a specific gap the IUR-Türkiye framework is designed to close: URE benefits depend on structured participation, not exposure; faculty mentorship requires institutional recognition, since willingness alone is insufficient where incentives are misaligned; and equitable access requires curricular embedding, because competitive models cannot reach the scale a system of 3.5 million undergraduates demands.

3. Methodology

This study uses a two-strand qualitative design combining a scoping review of the national literature with a policy document analysis of key Turkish higher education texts. Following Grant and Booth's (2009) typology, a scoping review assesses the size and scope of available research and identifies the nature and extent of the evidence, which is the goal of the literature strand. Consistent with this design, no formal quality assessment was applied; the aim is to characterize the scope, disciplinary distribution, and conceptual orientation of the evidence rather than to synthesize effect estimates. This fits the study's primary aim: to map the existing landscape of undergraduate research in Türkiye and develop a contextually grounded policy framework (IUR-Türkiye), not to test hypotheses. The two strands are integrated sequentially (Creswell & Plano Clark, 2018): the scoping review maps the empirical gap (what has been studied and practiced at the institutional level), while the policy document analysis maps the governance gap (what has been mandated and monitored at the national level). The convergence of these two analyses forms the foundation for the IUR-Türkiye framework proposed in Section 5.

3.1. Strand 1: Scoping Literature Review

3.1.1. Search Protocol

A structured search was conducted across three national repositories: TR Dizin (Türkiye's national peer-reviewed journal index), YÖK Thesis Center (the national thesis database), and DergiPark (the main open-access platform for Turkish journals). The search ran between January and April 2025, using a multi-term strategy combining Turkish and English keywords across title, abstract, and keyword fields (see ▶**Table 2**).

Table 2. Search Term Matrix

Search Term	Language	DergiPark	TR Dizin	YÖK Tez
Bilimsel araştırma	Turkish	✓	✓	✓
Araştırma eğitimi	Turkish	✓	✓	✓
Araştırmaya yönelik kaygı	Turkish	✓	✓	✓
Araştırmaya yönelik tutum	Turkish	✓	✓	✓
Lisans araştırma	Turkish	✓	✓	✓
TÜBİTAK 2209	Turkish	✓	✓	✓
TÜBİTAK proje	Turkish	✓	✓	✓
Undergraduate research	English	✓	✓	✓

All eight terms were searched across all three databases. The initial hit counts for each keyword–database combination were not systematically logged at retrieval; because broad terms such as "bilimsel araştırma" returned tens of thousands of records in DergiPark, most of them immediately identified as irrelevant on title inspection. This procedural limitation is discussed further in Section 3.3.

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3.1.2. Inclusion and Exclusion Criteria

Records were assessed against the pre-specified criteria presented in ▶Table 3.

3.1.3. Screening and Selection

Screening followed a two-stage protocol. In Stage 1, titles and abstracts of all retrieved records were reviewed against the inclusion criteria. Because the initial keyword searches returned tens of thousands of records, dominated by items identifiable as irrelevant from the title alone, the raw hit counts were not systematically logged; screening therefore began at the title and abstract level. In Stage 1, titles and abstracts were reviewed against the inclusion criteria, yielding 85 records retained across the three databases (DergiPark n=41, TR Dizin n=32, YÖK Tez n=12). In Stage 2, after removing nine duplicates, the full texts of the remaining records were obtained and re-evaluated. The final corpus of 76 studies was assembled as presented in ▶Figure 2. The reported figures thus represent records retained after title-abstract screening, not raw database outputs, a procedural limitation discussed in Section 3.3.

The complete reference list of all 76 included studies,

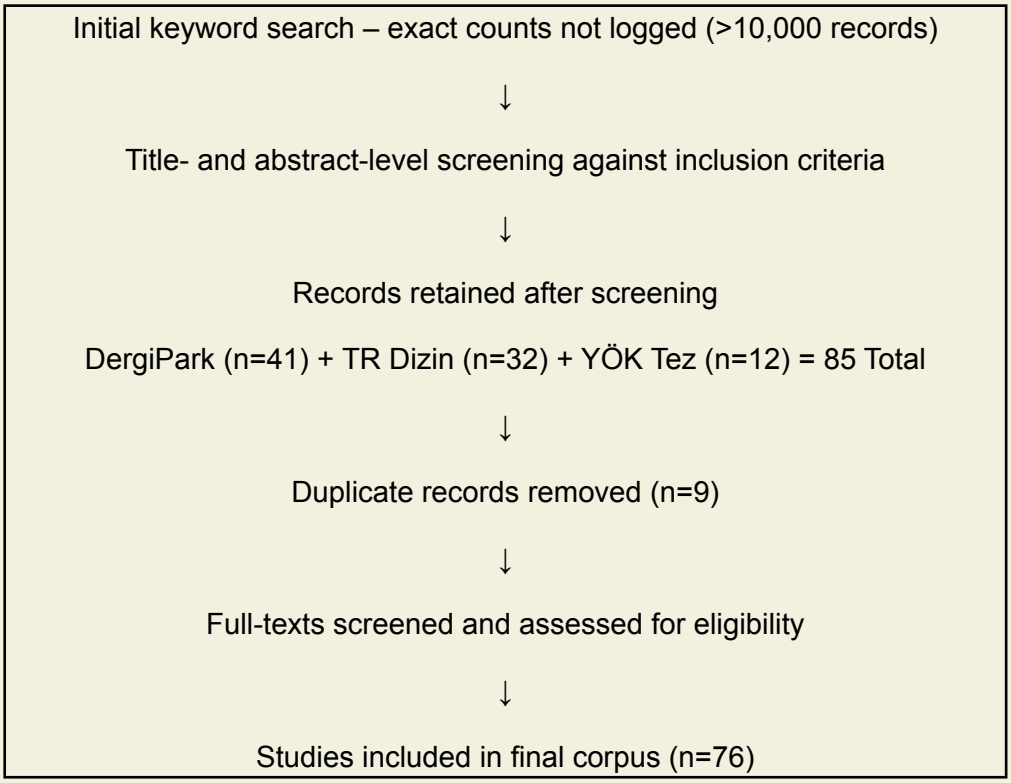


Figure 2. Literature Selection Process

Table 3. Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Language	Turkish or English	Other languages
Publication type	Peer-reviewed journal articles; master's and doctoral theses	Conference abstracts without full text; book chapters
Population	Undergraduate students; or faculty/institutions in relation to undergraduate research	Studies focused exclusively on graduate (master's/doctoral) or secondary school populations
Context	Turkish higher education institutions	Studies reporting exclusively on international or cross-national populations with no Turkish component
Thematic relevance	Studies addressing undergraduate engagement in research in any form (attitudes, self-efficacy, program outcomes, institutional practices, policy analysis)	Studies using the word "araştırma" (research) solely in the methodological sense without addressing undergraduate research as the central topic
Temporal scope	No date restriction applied; corpus spans 1994–2025, reflecting the earliest retrievable publication meeting inclusion criteria	-

along with their dimensional codes, is provided as Supplementary Table A.

3.1.4. Data Extraction and Coding

Each study was coded along these dimensions: (a) publication type (journal article / thesis), (b) year, (c) disciplinary field, (d) methodological approach (quantitative / qualitative / mixed / theoretical / document analysis), (e) substantive focus (attitudes; self-efficacy; program outcomes; institutional analysis; other), and (f) URE-alignment score, the degree to which the study addressed undergraduate research as authentic student participation in knowledge creation, consistent with the international definition (Healey & Jenkins, 2009; Linn et al., 2015).

Studies were coded as URE-aligned (score = 1) only when they reported structured student participation in an original inquiry project involving faculty supervision, data collection, and at least the presentation or dissemination of findings. Studies examining undergraduate attitudes toward research, or analyzing institutional funding structures without reporting student participation, were coded as non-URE-aligned (score = 0). On this criterion, eight distinct research projects were identified as URE-aligned, represented by nine publications (Demir, 2024 and Demir & İnanıcı, 2024 derive from the same doctoral project and are counted as one study; see Supplementary Table A); the remaining 67 address research-related constructs (attitudes, self-efficacy, anxiety, methods course experiences) or institutional mechanisms without meeting the participatory criterion. This scarcity is itself a key finding, indicating that authentic URE remains largely absent from the national landscape. A descriptive analysis of the coded corpus then identified temporal trends, disciplinary distribution, and conceptual gaps.

3.2. Strand 2: Policy Document Analysis

The second strand systematically analyzed key Turkish higher education policy documents. Policy document analysis is an established qualitative method for examining how policy problems are framed, what assumptions underlie proposed solutions, and what gaps exist between stated intent and operational practice (Bowen, 2009; Cardno, 2018).

3.2.1. Document Selection

Documents were identified in two steps. First, YÖK's official website was searched using terms such as "yükseköğretimde araştırma" and "araştırma üniversitesi.» Second, the national policy agenda was reviewed for documents on research capacity, student participation, or higher education quality issued by recognized authorities (YÖK, the Presidency of the Republic, and quality assurance bodies). Documents were included if they: (a) were issued by a recognized national authority; (b) fell within 2022–2025, the most recent and active policy cycle for research university development in Türkiye; and (c) referenced, explicitly or implicitly, undergraduate engagement in research or research-integrated education. This yielded seven policy documents, listed in ▶Table 4 (Section 4).

3.2.2. Analytical Framework

Each of the seven documents was analyzed using a descriptive content analysis approach (Bowen, 2009), combining a full reading with a targeted keyword search using terms such as "lisans," "araştırma," "öğrenci," and "mentorluk." This ensured both contextual understanding and systematic coverage. The analysis was structured around three questions: (1) Does the document reference undergraduate student engagement in research? (2) What accountability mechanisms or performance indicators are proposed or implied? (3) What structural gaps are evident between stated goals and operational measures? Findings were mapped against these categories, and cross-document comparisons traced the evolution of URE-related discourse across the policy timeline.

3.3. Limitations of the Research Design

Several limitations are acknowledged. First, the coding of the 76-study corpus was not subject to inter-rater reliability testing; future replications should use dual-coder procedures. Second, the initial hit counts for each keyword–database combination were not systematically recorded before relevance screening. This is consistent with the scoping review design (Grant & Booth, 2009), which does not require a full PRISMA-compliant flow diagram, and the reported figures (DergiPark n=41, TR Dizin n=32, YÖK Tez n=12) represent records retained after screening, not raw outputs. Third, the search was restricted to three Turkish-language repositories, so studies published solely in international databases may have been missed, though this is unlikely given the study's national focus. Fourth, since data collection concluded in April 2025, developments from May 2025 onward are not captured, and the 2025 data should be treated as partial-year figures. These limitations define the boundary conditions for the proposed framework but do not undermine its core claims.

4. Undergraduate Research in Türkiye: Context, Policy, and Practice

4.1. National Context and Policy Developments

In Türkiye, undergraduate research has gained policy visibility over the past decade. The conceptual groundwork was laid by Çetinsaya's (2014) influential roadmap for Turkish higher education, which framed growth,

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quality, and internationalization as the system's strategic priorities and provided the policy rationale for subsequent research-university reform. Building on this foundation, YÖK's 2017 Research-Oriented Mission Differentiation and Specialization Initiative designated specific universities to drive innovation and, aligned with the National Technology Initiative, prioritized training undergraduate researchers to develop the national workforce (Koyuncu et al., 2021; YÖK, 2019), and a succession of national policy documents has since increasingly referenced research-integrated education (see ▶**Table 4**). Yet engagement remains limited as research is traditionally seen as faculty- or postgraduate-driven, and existing mechanisms (TÜBİTAK grants, institutional Research Support Programs (BAP), and honors programs) operate independently rather than within a coordinated national framework.

As ▶**Table 4** shows, these documents share a consistent pattern: they articulate increasingly ambitious goals for research engagement while providing no operational mechanism to achieve or measure them. The Twelfth Development Plan (2024–2028) prioritizes integrating students into funded projects as a pipeline for cultivating scientific identity and graduate-study motivation (Presidency of the Republic of Türkiye, 2023; Russell et al., 2007), and YÖK's Strategic Plan (2024–2028) identifies the lack of research-based learning as a systemic weakness, yet neither specifies performance indicators (Yükseköğretim Kurulu, 2023). More significantly, the Roadmap Towards 2030 encourages research participation for high achievers while suggesting reduced undergraduate enrollment in research universities (Yükseköğretim Kurulu, 2022), a selective logic that contrasts with the General Report on University Monitoring and Evaluation (Yükseköğretim Kurulu, 2024), which tracks postgraduate outputs but provides no metrics for undergraduate participation. Across the policy corpus, the goal consistently outpaces accountability.

4.2. Existing Institutional Practices

Within this evolving landscape, undergraduate research in Türkiye is supported through three clusters of national programs.

The first cluster includes scholarship-based initiatives (e.g., TÜBİTAK 2209-A/B) and internships (STAR, BİÇABA). These promote inquiry-based learning and methodological training but remain largely extracurricular and short-term. The second cluster, scientific event support (TÜBİTAK 2224 series, 4001), funds conference participation and science fairs, enhancing communication skills and community engagement. The third and most significant cluster involves faculty-led research projects employing undergraduate assistants through national (TÜBİTAK 1001, 1003) and institutional channels, specifically Scientific Research Projects (Bilimsel Araştırma Projeleri [BAP]). While these provide formal opportunities, they function largely as administrative extensions of faculty scholarship rather than pedagogically designed learning experiences.

Table 4. Policy Documents Referencing Undergraduate Research

Policy Document	Year	Issuing Body	Relevant Policy Statements	Implications for URE
Research-Oriented Mission Differentiation and Specialization Initiative	2017	YÖK	Designated Research Universities to strengthen institutional research capacity.	Foundational policy shift implicitly requiring the cultivation of the next generation of researchers
Strategic Plan (2024–2028)	2023	YÖK	Identifies lack of practical components as a systemic weakness.	Acknowledges the gap in research-based learning but lacks prescriptive measures.
Twelfth Development Plan (2024–2028)	2023	Presidency of the Republic of Türkiye	Calls for including students in publicly funded R&D projects and strengthening mentoring.	Recognizes early-stage research engagement as integral to building national R&D capacity.
KDDP/UKAP Evaluation and Accreditation Framework	2023–2024	YÖKAK	Establishes accreditation criteria for undergraduate program quality; implicitly references research-integrated learning outcomes as a quality indicator.	Provides the accreditation mechanism through which URE participation can be enforced at the program level; closest existing equivalent to a formal accountability lever for undergraduate research.
General Report on University Monitoring and Evaluation	2024	YÖK	Reports data on TÜBİTAK-funded research and training scholarships.	Offers evidence of URE support but lacks separate metrics for undergraduate participation.
Towards 2030: The Roadmap of Turkish Higher Education	2025	YÖK	Encourages high achievers to engage in research; suggests limiting undergraduate enrollment.	First explicit reference to UREs; emphasizes selective participation.
Press Release on Three-Year Undergraduate Programs	2025	YÖK	Announces reforms for high achievers focusing on "projects, practice, and research."	Signals a shift toward experiential learning aligned with international models.

Across Turkish research universities, most organized undergraduate research opportunities sit within the BAP framework, a mandatory institutional funding mechanism established by YÖK (see ▶Table 5), under which Undergraduate Student Research Projects let faculty include undergraduates in funded research. The framework has two structural limitations. First, student involvement is often task-specific, determined by faculty needs (e.g., data collection), rather than covering the full inquiry cycle. Second, participation is typically non-credit bearing and relies on competitive, short-term funding. This prevents course-embedded, scaffolded progress and reinforces the view of research as temporary employment rather than a foundational educational experience.

Independent and curricular models such as Sabancı University's PURE, Koç University's KUSRP, and course-based research at Bilkent and METU remain few. ▶Table 6 compares these four programs across six dimensions: approximate founding year and operational scale, funding model, curricular integration, formal recognition of faculty mentorship, disciplinary coverage, and visibility of student outputs. They represent four distinct responses to the URE integration challenge, differing markedly in scalability, sustainability, and disciplinary reach. PURE and KUSRP adopt an extracurricular summer model prioritizing depth for a small, competitively selected cohort. Bilkent University's CS390/CS490 is the only fully curricular model, embedding research into a single department's degree requirements. AdımODTÜ pursues breadth through a donor-funded, all-faculty grant scheme that has scaled rapidly since 2018, and whose integration with TÜBİTAK 2209-A is the closest existing approximation to the pipeline logic proposed in the study. While these examples demonstrate the potential of

Table 5. Typology of Undergraduate Research Opportunities at Turkish Research Universities

University	BAP Student Research Projects	Hybrid Models (BAP + Departmental Initiatives)	Independent & Institutionalized URE Programs
Koç University			Koç University Summer Research Program (KUSRP)
Sabancı University			Program for Undergraduate Research (PURE)
Middle East Technical University (METU)	✓	AdımODTÜ / MATTER Journal	
Istanbul Technical University (ITU)	✓	LÖKAP-A & LÖKAP-T (Competition Track)	
Bilkent University			CS390 / CS490 Independent Research Courses
Boğaziçi University	✓		
Ankara University	✓		
Hacettepe University	✓		
Erciyes University	✓		
Istanbul University	✓		
Istanbul University – Cerrahpaşa	✓		
Ege University	✓		
Gazi University	✓		
Atatürk University	✓		
Dokuz Eylül University	✓		
Fırat University	✓		
Bursa Uludağ University	✓		
Çukurova University	✓		
Karadeniz Technical University	✓		
Yıldız Technical University	✓		
Marmara University	-	LKP (Undergraduate Student Research Projects); LIFT UP (TUSAŞ-partnered industry-oriented Capstone Program)	
İzmir Yüksek Teknoloji Enstitüsü (İYTE)	-		
Gebze Technical University	✓*		

*Undergraduate students may participate as project team members; direct bursary payments to undergraduates are not permitted under BAP regulations (GTÜ ADEP Call Document, 2026).

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structured, credit-bearing ecosystems, they have not yet been replicated nationally (Koç University, n.d.; Sabancı University, n.d.; Middle East Technical University, n.d.).

National survey data offer further insight into how students perceive these mechanisms. The *Türkiye University Experience Survey (TÜDA 2025)* (Yükseköğretim Kurulu, 2025), conducted by the Council of Higher Education with over 260,000 students across 205 universities, found that only 56% of undergraduates feel encouraged by their instructors to engage in research, project development, or publication, and just 51% agree that research opportunities at their universities are sufficient. These findings suggest that while awareness exists, access and mentoring remain limited, reflecting an ongoing policy–practice gap. Overall, Türkiye's landscape is emerging but fragmented, rich in individual initiatives but lacking institutional cohesion. The key dimensions of this gap and the necessary reforms are summarized in Box 1.

The challenges in Box 1 show that current policy ambitions are stifled by fragmented practice. The following section proposes a comprehensive framework for systematically embedding undergraduate research within Türkiye's research university ecosystem.

4.3. Review of National Literature: Scope, Trends, and Gaps

This analysis draws on a scoping review of 76 national

Table 6. Comparative Overview of Institutionalized URE Programs at Selected Turkish Research Universities

Dimension	Sabancı University — PURE	Koç University — KUSRP	Bilkent University — CS390/CS490	METU — AdımODTÜ
Approximate founding year & operational scale	Est. alongside university (1994); summer cohort of ~30 YTB-funded international students + open domestic/SU enrolment; Fall/Spring tracks available exclusively for SU students	Est. alongside university (1993); open summer cohort for undergraduate, graduate, and high school students from any university; no stated cap	CS390 from sophomore year; CS490 as senior technical elective; Spring 2025: 23 students active across both courses	Est. 2018; 242 projects, 1,062 undergraduate students funded across 2018–2022 (17→27→57→64→77 projects per year)
Funding model	YTB (Türkiye Scholarships) covers airfare, accommodation, and monthly stipend (~13,000 TL) for 30 international students; free accommodation for all accepted internationals; no fee for domestic participants; no direct bursary to SU students in Fall/Spring tracks	Free of charge for all participants; no stipend stated; accommodation arrangements left to participants	No direct financial support; program operates through standard credit-bearing course structure within CS department budget	Donor-funded endowment (AdımODTÜ/METU Development Foundation); TÜBİTAK 2209-A-eligible students additionally supported by AdımODTÜ supplementary fund
Curricular integration level	Low–medium: summer program is extracurricular; may count as internship for non-SU students under home university rules; Fall/Spring tracks integrated into SU academic calendar but remain optional	Low: extracurricular summer program; may count as internship for non-SU students; no credit-bearing equivalent at Koç	High: CS390 and CS490 are credit-bearing elective courses in the CS undergraduate curriculum; CS490 carries 3 credits and ECTS recognition	Low–medium: extracurricular grant program; not credit-bearing; integrated with TÜBİTAK 2209-A pipeline as complementary funding layer
Formal recognition of faculty mentorship	Faculty propose and supervise projects; no public documentation of promotion-linked recognition for URE supervision	Faculty propose and supervise projects; no public documentation of promotion-linked recognition	Faculty supervision embedded in course delivery; supervision counts toward teaching load as standard course responsibility	Faculty evaluate project applications and may serve as advisors; no formal promotion-linked recognition identified; advisor role is voluntary
Disciplinary coverage	All disciplines (engineering, natural sciences, social sciences, arts); project portfolio determined by faculty availability each cycle	All disciplines; project portfolio determined by participating faculty	Computer Engineering only (CS department); no cross-faculty equivalent identified	All departments and faculties; projects span natural sciences, engineering, social sciences, and humanities
Visibility of student outputs	Certificate of participation; final report submitted to university system; poster and presentation at end-of-program event; seminars	Certificate of participation upon completion; no institutionalized publication or conference output described	Formal presentations to faculty audience (end-of-semester event); experience in academic article writing explicitly stated as program goal	MATTER — Türkiye's first undergraduate research journal (peer-reviewed); Annual AdımODTÜ Undergraduate Research Day (public presentation event); eligibility for Global Undergraduate Research Awards (international conference)

Sources: Sabancı University PURE program website (pure.sabanciuniv.edu, accessed March 2025); Koç University Summer Research Program website (research.ku.edu.tr/research-outreach/summer-research/kusrp, accessed March 2025); Bilkent University Computer Engineering Department undergraduate research page (w3.cs.bilkent.edu.tr/undergraduate-research, accessed March 2025); METU Haber (haber.metu.edu.tr, February 2024); AdımODTÜ 2022 brochure (adimodtu.org.tr). Funding and stipend figures reflect program documentation available as of March 2025 and are subject to annual revision.

studies (1994–2025) from TR Dizin, YÖK Thesis Center, and DergiPark, using keywords such as "lisans öğrencisi araştırma" and "TÜBİTAK 2209." Inclusion criteria selected studies addressing undergraduate engagement in any form, excluding solely graduate or international contexts. The review maps the empirical landscape to assess alignment with international URE models.

4.3.1. General Trends and Conceptualization of Research

The review shows that Türkiye's engagement with undergraduate research is examined mainly through pedagogical and attitudinal lenses rather than structured institutional practice. The fragmented literature focuses on constructs such as self-efficacy (Kart & Gelbal, 2014; Tuncer & Yılmaz, 2017), attitudes toward research (Bahtiyar & Can, 2016; İlhan et al., 2016; Şahin Kürşad, 2015; Uysal Toraman et al., 2013), and research anxiety (Bulduk & Alp, 2021; Çokluk Bökeoğlu & Yılmaz, 2005). Research is typically treated as a taught competence, often via methods courses, rather than a process of active inquiry (Aksu, 2018). Students therefore tend to see research as a postgraduate, faculty-centered activity relevant mainly to academic careers (Anapa, 2019; Bahtiyar & Can, 2016; İlhan et al., 2016), though they recognize its benefits for employability and intellectual growth, particularly in project-based or course-integrated contexts (Arısın et al., 2024; Korkut, 2018; Mandıracıoğlu et al., 2016).

4.3.2. Temporal Distribution and Disciplinary Focus

Publication volume has risen notably, increasing sharply after 2010. This growth correlates with teacher education reforms, the TÜBİTAK 2209-A/B programs, and YÖK's 2017 Research University Initiative, making the 2020s the most active period.

Disciplinary analysis (see ▶**Table 7**) reveals a concentration in education and teacher training (50 studies), followed by health sciences (15), while engineering and natural sciences remain significantly underrepresented with a single study. This reflects the strong pedagogical orientation of Türkiye's research culture, contrasting with international models where STEM fields traditionally drive URE development.

This asymmetry between education and teacher training and engineering and natural sciences is not a random artefact of the search; it reflects four interlocking structural factors specific to the Turkish context.

First, the size and weight of education faculties inflate the volume of pedagogical research. With over 200 faculties of education and a high proportion of staff working in educational science, survey-based studies on research attitudes, methodological self-efficacy, and methods course outcomes are structurally incentivized. These are mostly published in Turkish-language journals indexed in DergiPark and TR Dizin, the repositories searched here, and they treat research as any inquiry-based coursework, regardless of whether it meets the interna-

Box 1. Policy–Practice Gap in Türkiye

P1. Policy recognition, missing metrics. National plans endorse early research engagement, but performance frameworks lack measurable indicators for URE participation or mentorship.
P2. Fragmented instruments. TÜBİTAK and BAP operate as separate, grant-based mechanisms rather than integrated, curriculum-anchored systems.
P3. Faculty-centric design. Programs are organized through faculty projects instead of student-oriented institutional pipelines.
P4. Scale vs. equity. Opportunities are short-term, competitive, and unevenly distributed.
P5. Governance misalignment. Faculty promotion models reward outputs but rarely recognize URE mentorship or curricular integration.

Critical Areas for Institutional Reform:

- **Mandating Accountability:** Integrate URE indicators (e.g., participation rates, mentorship hours) into YÖK frameworks to ensure accountability.
- **Curricular Transformation:** Embed credit-bearing, scalable models (CUREs) to create structured pathways to advanced programs.
- **Centralized Governance:** Establish dedicated Undergraduate Research Offices/Centers to coordinate advising and link scholarship with student opportunities.
- **Faculty Recognition:** Reform promotion criteria to formally recognize sustained mentorship, supported by targeted micro-grants.
- **Equitable Access and Progression:** Ensure broad access via tiered entry points, from mandatory inquiry courses to selective fellowships.

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tional URE threshold of authentic knowledge creation.

Second, YÖK's Academic Incentive Regulation (Akademik Teşvik Yönetmeliği), governing promotion and bonuses since 2016, awards points mainly for publications in national Turkish-language journals and domestic conference presentations. This channels educational science faculty toward rapid-cycle, survey-based output suited to DergiPark, while STEM faculty, whose publication norms favor English-language Web of Science or Scopus venues, produce relatively little Turkish-language indexed research on UREs. The result is a systematic database-level underrepresentation of STEM URE activity, even where it exists as laboratory apprenticeships and TÜBİTAK-funded projects.

Third, the framing of "research" diverges between the two traditions. In STEM, undergraduate participation is largely absorbed into laboratory practice, senior design projects, and TÜBİTAK 2209-A/B involvement, rarely reported as standalone research publications in national outlets. In Educational Sciences, survey-based studies on preservice teachers' "research attitudes" or "research anxiety" form a well-established, frequently published subgenre, making the construct highly visible in database searches. The two traditions operationalize "undergraduate research engagement" so differently that a keyword search inevitably captures far more of the educational science variant.

The implication is significant: the low presence of STEM in the national URE literature does not mean STEM undergraduates are less engaged in research. Rather, STEM URE activity is (a) published in international, English-language outlets not captured by the three databases, (b) embedded in laboratory and project work not reported as a distinct pedagogical intervention, and (c) undertheorized as a category in Turkish STEM education research. This matters for Section 5: any proposal to extend CUREs into STEM must address not only the structural barriers to curricular embedding but also the absence of a published Turkish evidence base that would make such a proposal visible to domestic policymakers. Building that base, through Turkish-language STEM URE studies indexed in DergiPark and TR Dizin, is therefore a precondition for legitimating STEM-focused URE curricula within the YÖK quality assurance framework.

4.3.3. The URE Literature Gap

Despite the sharp rise in publication volume, the literature on authentic UREs remains strikingly scarce. Within this corpus, only eight distinct research projects meet the international definition of authentic undergraduate research participation (see Supplementary Table A). The coding criterion was stringent and consistent with Healey and Jenkins's (2009) research-based quadrant and Linn et al.'s (2015) CURE definition: a study was coded as URE-aligned only when it reported structured undergraduate participation in an original inquiry project involving faculty supervision, student-led data collection, and the presentation or dissemination of findings.

Three examples illustrate the logic. Mandıracıoğlu et al. (2016) reported a structured research training program at Ege University's medical faculty in which undergraduates designed and conducted original projects under faculty supervision and presented findings at an institutional symposium, meeting all four criteria. Korkut (2018) documented a course-based scientific research convention in an ELT department in which students conducted and publicly presented original inquiry projects as part of a credit-bearing course, again meeting all criteria. By contrast, Bilasa and Taşpınar (2019), one of the most-cited studies in the corpus, measured pre-service teachers' attitudes toward a scientific research methods course using a Likert-scale instrument; students attended the course but did not conduct original research, so the study measured attitudes, not participation, and was coded as not URE-aligned. This distinction, between learning about research and participating in research, is the central analytical divide the corpus analysis documents.

The eight URE-aligned projects cluster in two fields. The first is medical education (Arısın et al., 2024;

Table 7. Distribution of National Undergraduate Research Studies by Discipline (1994–2025)

Discipline / Field	No of Studies	Typical Focus Areas
Education / Teacher Training	50	Attitudes toward research, research methods courses, self-efficacy, preservice teacher projects
Health & Medical Sciences	15	URE programs, scientific training, motivation in medical education
Social Sciences	5	Research culture, communication/sociology projects
Interdisciplinary	5	Institutional research policies, funding, BAP units
Engineering & Natural Sciences	1	Student projects, capstone experiences, research skill development

Data derived from the dataset compiled by the author.

Demir, 2024; Demir & İnanıcı, 2024; Mandıracıoğlu et al., 2016), where structured research-training programs have produced the most sustained examples of authentic undergraduate inquiry. The second is teacher education, spanning music, language, science, and mathematics teaching (Aksu, 2018; Anapa, 2019; Korkut, 2018; Muşlu Kaygısız et al., 2020; Sevimli et al., 2025), where project-based and course-embedded models have emerged largely around TÜBİTAK 2209-A participation. Across both clusters, the projects relied on external funding, primarily TÜBİTAK, or institutional research-training programs rather than embedded curricular requirements, confirming that authentic URE in Türkiye remains grant-dependent and extracurricular rather than structurally integrated.

This scarcity of institutional analysis suggests UREs are still seen as extracurricular rather than standard practice. Comprehensive studies on systematic frameworks, mentorship, or funding models comparable to international standards are absent, highlighting a significant conceptual and structural gap between policy aspirations and practice. The following section moves beyond this gap to explore how embedding UREs within research universities aligns with national goals for excellence and innovation.

5. Conceptual and Policy Framework for Integrating Undergraduate Research in Türkiye

5.1. Rationale and Conceptual Foundations

The findings in Section 4 define a bounded policy problem: Türkiye has the infrastructure to support undergraduate research (designated research universities, TÜBİTAK grants, BAP funding, and four pioneering URE programs) but lacks the coordinating architecture that would make participation a structural expectation rather than an individual achievement. The scoping review identified eight URE-aligned projects in three decades of literature, and the policy analysis found no operationalizable performance indicators for undergraduate research in any of the seven key documents. Together, these findings define the problem IUR-Türkiye is designed to solve: not a lack of awareness or goodwill, but a lack of institutional architecture connecting policy ambition to measurable practice.

The framework builds on the synthesis in Section 2: Ozay's (2012) DRUL model provides the curricular logic, Healey and Jenkins's (2009) typology the pedagogical vocabulary, and Linn et al.'s (2015) CURE principles the scalability mechanism. The goal is not to replicate elite apprenticeship models at scale, but to embed research as a universal curricular expectation, beginning with course-based experiences accessible to all students and progressing to competitive, faculty-led projects for those who develop the necessary competencies. The following sections present the five dimensions of the model and the three-tiered implementation architecture.

5.2. International Models and Transferable Principles

Contemporary URE ecosystems differ in curricular integration, mentorship structure, and student autonomy, yet share a set of transferable design principles (Baker et al., 2022; Corwin et al., 2015; Dolan, 2016; Linn et al., 2015): (1) Integration, embedding research in the formal curriculum rather than as extracurricular enrichment; (2) Mentorship, structured supervision connecting faculty, graduate mentors, and peers; (3) Progression, entry points across academic levels from introductory inquiry to advanced thesis projects; (4) Recognition, rewarding participation through credit, stipends, or transcript acknowledgment; (5) Dissemination, scholarly communication through conferences and student journals; and (6) Inclusivity, equitable access across disciplines and underrepresented groups (Bangera & Brownell, 2014; Haeger et al., 2020). Together these principles guide locally adaptable URE ecosystems aligned with institutional priorities and resources.

5.3. Adapting The Framework to the Turkish Research University Context

Türkiye's large undergraduate populations, centralized governance, and growing research ambitions present both challenges and opportunities for embedding UREs. Rather than replicating Western models, the goal is to adapt their guiding principles to Türkiye's institutional realities and policy environment.

The Conceptual Framework for Integrating Undergraduate Research in Türkiye (IUR-Türkiye) adapts international best practices to the country's specific governance and institutional conditions. As illustrated in ▶**Figure 3**, the model positions the five integration dimensions within the three governance levels (policy, institutional, and programmatic), framed on one side by international models and national policy inputs and on the other by the doctoral human capital and national innovation goals the system is intended to serve.

IUR-Türkiye draws on, but intentionally departs from, the three international frameworks most cited in URE policy: Healey and Jenkins's (2009) research-teach-

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ing nexus typology, Linn et al.'s (2015) CURE design principles, and Hensel and Blessinger's (2020) map of undergraduate research across institutional contexts. Each has shaped the international agenda, but none was designed for a system combining mass enrollment, centralized YÖK governance, a postgraduate-dominated research culture, and an incentive structure (Akademik Teşvik Yönetmeliği) that separates undergraduate teaching from research evaluation. ▶Table 8 positions IUR-Türkiye against these frameworks across four dimensions, identifying the Türkiye-specific discriminators that justify a locally grounded model.

Four Türkiye-specific differentiators emerge. First, IUR-Türkiye integrates the existing BAP funding infrastructure into the CURE design logic, rather than treating CURE as an innovation requiring new resourcing. Second, it is the only framework among the four to address the faculty promotion incentive structure: by proposing formal recognition of URE mentorship within the Akademik Teşvik Yönetmeliği, it targets the disincentive that makes undergraduate supervision professionally invisible. Third, it incorporates the TÜDA 2025 national survey as a built-in monitoring instrument, providing a legitimate baseline without new data infrastructure. Fourth, rather than treating TÜBİTAK 2209-A/B as the primary entry point (the current implicit assumption), it positions these competitive schemes as an advanced tier fed by a broader CURE pipeline, reversing the logic in which grants serve as the first rather than final stage. Together these make IUR-Türkiye a contextual adaptation grounded in the governance, incentive, and infrastructure conditions of Turkish research universities, not a translation of existing frameworks.

IUR-Türkiye functions as a conceptual guide rather than a fixed blueprint, prioritizing incremental, scalable implementation attached to curricular integration and faculty engagement, and laying the groundwork for central coordinating offices and sustainable recognition mechanisms. The model proposes five interconnected dimensions, each carrying a distinct policy implication.

These five dimensions span institutional integration (aligning URE with strategic plans and quality assurance, and including participation indicators in YÖK accreditation frameworks), faculty engagement and mentorship (recognizing supervision in promotion criteria and providing micro-grants or course releases), curricular embedding (introducing research-based learning through CURE-style courses and mandating research-linked outcomes in accreditation standards), student access and progression (building tiered introductory, mentored, and independent opportunities with equity safeguards), and dissemination and visibility (integrating undergraduate outputs into national recognition platforms such as YÖK Awards and TÜBİTAK showcases). Each dimension is operationalized in the three-tiered implementation model that follows.

5.3.1. A Three-Tiered URE Implementation Model for Türkiye

To operationalize the framework, a Three-Tiered Implementation Model is proposed (▶Figure 4), serving as the practical roadmap across the Policy, Institutional, and Programmatic levels.

5.3.1.1. Level I: Policy Governance (YÖK and National Agencies)

The Policy Level establishes structural reforms and accountability mechanisms to close gaps concerning the lack of measurable metrics and the fragmented grant system.

The first intervention introduces measurable performance metrics for undergraduate research participation, with YÖK and quality assurance bodies integrating URE indicators into existing monitoring and accreditation frameworks. A two-category structure is recommended. Breadth metrics, focused on scale and equitable access, would track the proportion of undergraduates completing at least one credit-bearing CURE annually and year-on-year growth in faculty-supervised research. Depth metrics, focused on quality and faculty commitment, would capture the proportion of projects resulting in disseminated outputs and documented faculty mentorship hours recognized in workload calculations. The proposed Undergraduate Research Participation Rate, anchored in the TÜDA survey infrastructure, would provide a legitimate baseline for assessing annual progress.

The second intervention repositions existing competitive grant programs, embedding TÜBİTAK 2209-A/B and institutional BAP funding within a broader URE pipeline rather than as standalone entry points. Competitive grants would serve as the advanced tier of a three-level progression, directing well-prepared students (those who have completed CURE and Research Skill Development coursework) into intensive, faculty-led projects with demonstrable R&D and doctoral pipeline value. This reverses the current logic in which competitive grants are simultaneously the primary access mechanism and the excellence benchmark.

5.3.1.2. Level II: Institutional Structuring (University and Central Offices)

This level translates policy mandates into practice by establishing the coordinating structures, recognition systems, and financial incentives needed to embed URE activity in research universities.

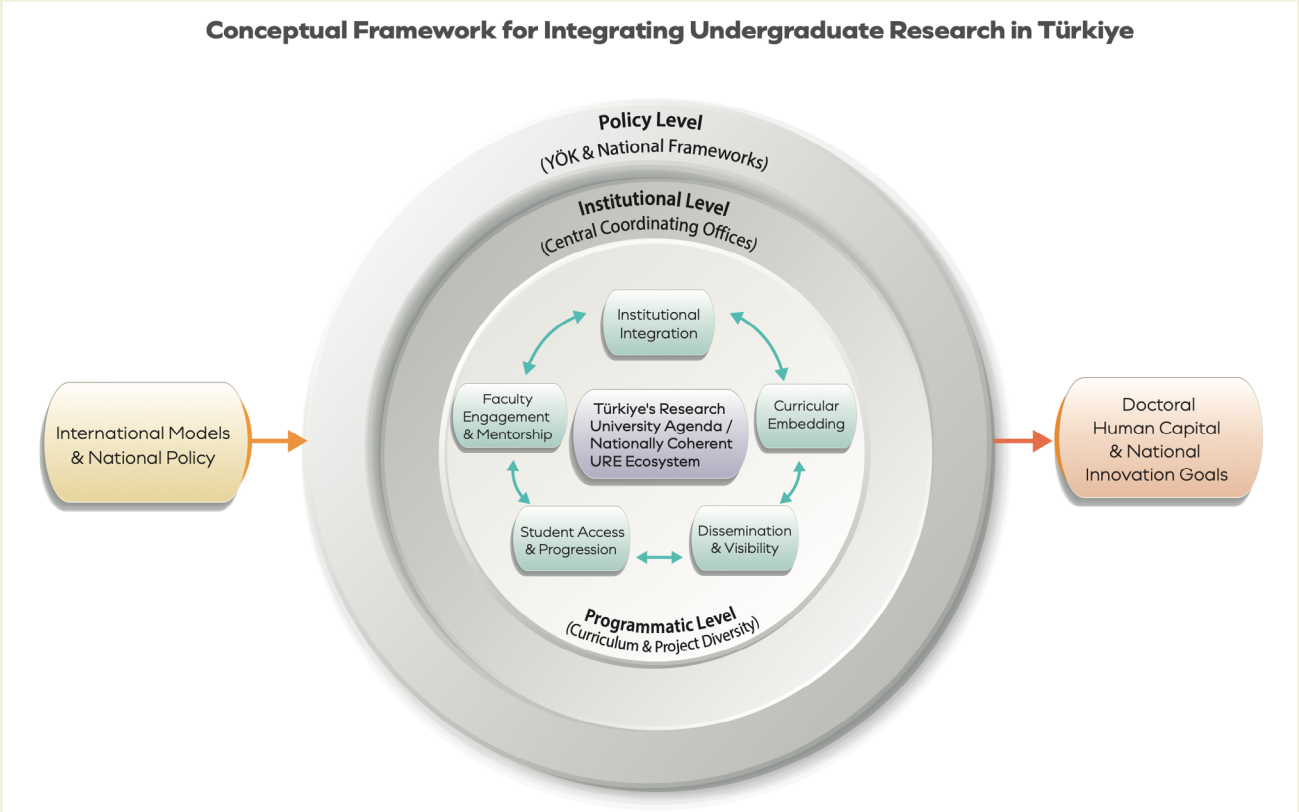


Figure 3. Conceptual Framework for Integrating Undergraduate Research in Türkiye (IUR-Türkiye)

Table 8. IUR-Türkiye in Relation to Predecessor International Frameworks

Dimension	Healey & Jenkins (2009)	Linn et al. (2015) — CURE Design	Hensel & Blessinger (2020)	IUR-Türkiye (present study)
Primary theoretical focus	Teaching–research nexus as a continuum from research-led to research-based pedagogy; four-quadrant typology of modes	Scalable course-based research experiences; iterative inquiry, collaboration, broader relevance as core CURE features	Inclusive undergraduate research across diverse institutional types (community colleges, HSIs, HBCUs); equity and access	Policy-governance integration across three tiers (YÖK, institution, curriculum); empirical and governance gap as dual diagnostic
Institutional context assumed	UK/European Bologna-compatible institutions with established research-teaching parity in faculty roles	US research universities with existing STEM lab infrastructure and credit-bearing course structures	US diversified higher education landscape with strong institutional autonomy	Turkish centralized governance with YÖK regulatory architecture, mass undergraduate enrollment, and ADEP/BAP funding pipelines
Mechanism for faculty engagement	Professional development and curriculum redesign framed as scholarly practice	Instructional support, CURE faculty communities of practice	Mentorship training, explicit equity commitment	Formal integration of URE mentorship into Akademik Teşvik Yönetmeliği promotion criteria; ADEP-linked micro-grant incentives for CURE-embedded courses
Scalability pathway	Progression along the research-teaching nexus continuum; institutionally variable	CURE replication and adaptation across STEM courses; documented at scale in US institutions	Tiered participation frameworks adapted to institution type and mission	Three-tier pipeline: TÜBİTAK 2209-A/B as advanced independent tier fed by CURE-embedded base tier; URO coordination as institutional middle tier
Feedback/monitoring mechanism	Not specified; framework is descriptive rather than evaluative	Student learning outcome assessment through validated CURE instruments (e.g., CURE Survey)	Institutional data collection; equity metrics	TÜDA 2025 survey infrastructure as national baseline; proposed "Undergraduate Research Participation Rate" metric within YÖK performance evaluation
Key Türkiye-specific differentiator	Does not address centralized governance context or promotion incentive structure	Does not address the absence of laboratory-based CURE culture in Turkish STEM education or the BAP funding architecture	Does not address postgraduate-dominated research culture or the conceptual displacement problem identified in Section 4.3.3	(1) BAP→CURE funding integration; (2) Akademik Teşvik–mentorship linkage; (3) TÜDA feedback loop; (4) TÜBİTAK 2209-A/B as pipeline capstone

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The central proposal is the establishment of dedicated Undergraduate Research Offices (UROs) at each of the ten designated research universities. A URO would coordinate advising, dissemination support, and data reporting for YÖK accountability metrics, bridging the gap between faculty scholarship and student opportunity that currently depends on informal connections. A URO would additionally administer a structured, multi-layered supervision system connecting faculty mentors, graduate student co-mentors, and peer researchers, distributing the mentorship burden more equitably and reducing the professional cost of supervision for individual faculty. The proposal builds on a recognized need in the Turkish higher education literature for dedicated institutional units to coordinate research activity and embed it within the YÖK-YÖKAK quality assurance architecture; analyses of university Application and Research Centers have similarly argued that such units must develop defined quality assurance processes, with measurable performance indicators and monitoring mechanisms, rather than operating as loosely governed administrative structures (Büyükgüzel et al., 2023).

The second intervention concerns faculty recognition and incentive reform. The framework proposes a tiered incentive architecture in which faculty who supervise credit-bearing CUREs or advanced thesis research receive weighted teaching load credit, formalizing mentorship as a recognized component of academic workload consistent with Boyer's (1990) expanded conception of scholarship and with calls to formally recognize undergraduate research mentorship in workload, tenure, and promotion systems (Morrison et al., 2019). This is complemented by accessible micro-grants for mentorship-related costs (student conference travel, consumable supplies, URO coordination) and by the formal integration of sustained, high-quality URE supervision as a criterion in promotion and evaluation. Without such reform, the structural disincentive identified in Section 4.1, whereby undergraduate mentorship constitutes professionally invisible labor, is likely to persist regardless of policy-level mandates.

5.3.1.3. Level III: Application and Curricular Integration

This level operationalizes the policy mandates and institutional structures from Levels I and II through credit-bearing, curriculum-embedded activities within departments. It is the primary point of student contact with the URE ecosystem.

Implementing Course-Based Undergraduate Research Experiences (CUREs): The central delivery mechanism is the CURE. By embedding genuine inquiry projects within required or high-enrollment courses, including general education and discipline-specific introductory courses, CUREs provide credit-bearing, mandatory access to authentic research for large cohorts, overcoming the scalability and equity limitations of one-to-one apprenticeship. CURE integration institutionalizes research as

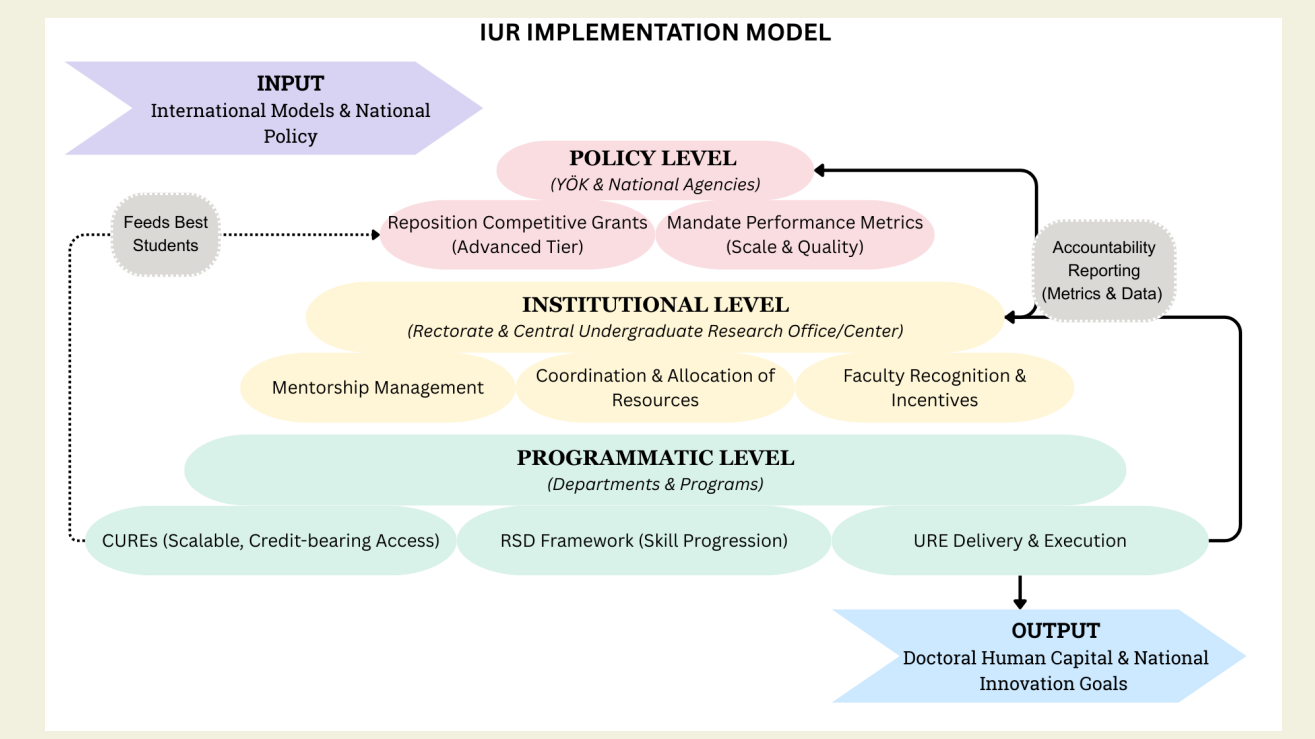


Figure 4. Three-Tiered IUR-Türkiye Implementation Model

a permanent curricular feature rather than a faculty-dependent add-on, enabling the Policy Level's breadth metrics to be achieved and monitored systematically.

Structured Research Skill Development (RSD): Alongside CUREs, the framework adopts a systematic approach to research literacy drawing on the Research Skill Development (RSD) Framework (Willison, 2018). By mapping inquiry competencies across the degree program, from foundational methodological awareness to independent research design and dissemination, the RSD approach ensures URE participation is a progressive trajectory rather than a discrete event, preparing students for the more intensive faculty-led and competitive opportunities at the upper tiers.

Tiered Opportunities and Execution: The programmatic level manages a tiered portfolio of URE models calibrated to different student abilities, motivations, and disciplinary contexts: from mandatory introductory CUREs, through mentored faculty projects, to selective thesis research and TÜBİTAK/BAP grant participation. This vertical differentiation ensures the pipeline feeds upward, directing students whose competencies have been developed through the lower tiers toward advanced opportunities whose selectivity and R&D value are maximized when the cohort is well-prepared rather than self-selected.

5.4. Toward a Nationally Coherent Ure Ecosystem

Embedding undergraduate research depends on coordinated action across three levels. At the policy level, national frameworks need to incorporate URE indicators into performance monitoring, quality assurance, and funding. At the institutional level, research universities should establish central coordinating offices for student engagement, mentorship, and dissemination. At the programmatic level, universities should diversify opportunities across disciplines by combining BAP-based projects with course-embedded and summer research models.

A phased roadmap is critical for managing this transition in large systems (▶**Figure 5**). It begins by establishing a foundational research culture through the RSD Framework (Phase I), which supports scaling inclusive access via credit-bearing CUREs (Phase II). This base creates a pipeline of prepared students ready for advanced, faculty-led projects supported by national mechanisms like TÜBİTAK (Phase III), allowing universities to manage transformation through systematic rather than reactive change.

Such a multi-layered approach can transform undergraduate research from isolated faculty initiatives into a coherent ecosystem supporting national research and innovation goals (Hensel & Blessinger, 2020). It also positions UREs as a mechanism for cultivating a research culture, strengthening the teaching-research nexus, and advancing Türkiye's vision of globally competitive and equitable research universities.

6. Discussion and Implications

This paper argues that undergraduate research remains an underutilized opportunity within Türkiye's research university ecosystem. Despite national policies for research excellence, innovation, and human capital development, URE integration is limited. Building on in-

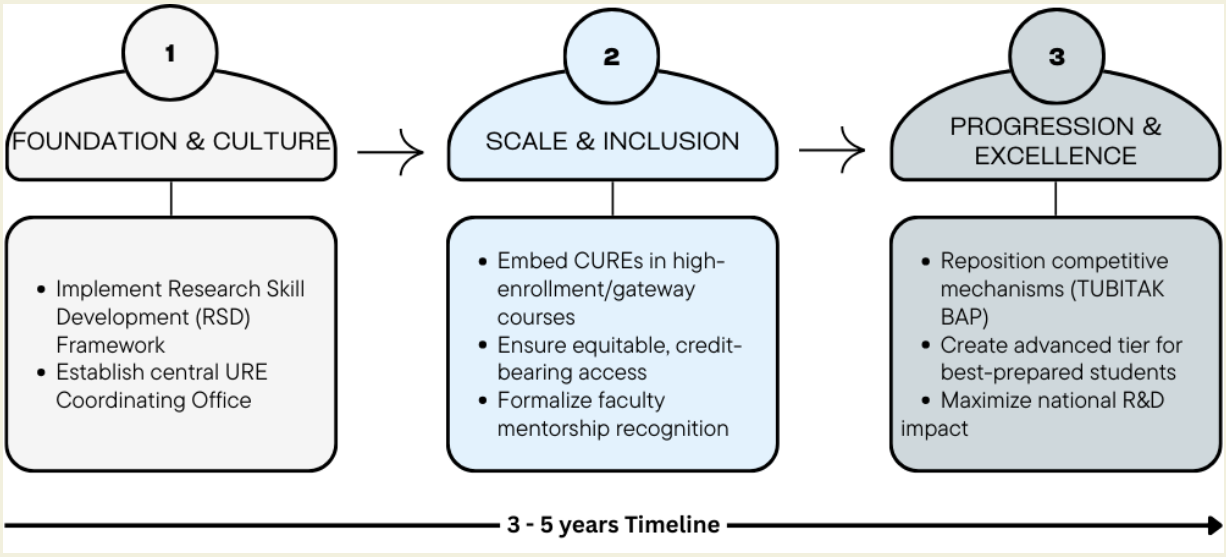


Figure 5. Three-Phased IUR Implementation Roadmap

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ternational models and emerging national frameworks, the study proposed a conceptual framework and a three-tiered implementation model to embed undergraduate research as a core institutional strategy.

6.1. Theoretical and Conceptual Contributions

The study makes three conceptual contributions, each grounded in the Turkish empirical context. The first is the identification of what this study terms conceptual displacement: the systematic substitution of attitudinal and competency constructs (research anxiety, self-efficacy, methods course perceptions) for structural participation constructs (authentic inquiry, faculty supervision, knowledge dissemination) in the national scholarly record. This is not merely a measurement artifact; it reflects and reinforces an institutional reality in which research is positioned as something students learn about rather than do. The 76-publication review, combined with the finding that only eight projects meet the international URE threshold, provides the first systematic documentation of this displacement in Türkiye, establishing a diagnostic baseline for future progress.

The second contribution is a dual gap framework distinguishing the empirical gap (what the literature documents) from the governance gap (what policy instruments mandate and measure). Prior studies of URE in emerging systems typically address either the pedagogical or the policy dimension in isolation. Integrating a scoping review with a policy document analysis enables a more precise diagnosis: Türkiye's URE deficit is not primarily a problem of institutional capability or faculty motivation, but of the absence of accountability mechanisms that make participation consequential for institutional performance. The implication is direct: capability-building programs will be insufficient without the governance architecture that creates demand for them.

The third contribution translates the international URE institutionalization typology (accreditation-driven in the U.S., research-evaluation-driven in the UK, learning-outcomes-driven in the EHEA) into the context of a centralized, mass higher education system. By mapping these mechanisms onto Türkiye's existing policy architecture (YÖKAK accreditation, Akademik Teşvik Yönetmeliği, TÜDA survey infrastructure), the study shows that the governance tools for URE institutionalization are already present; they simply have not been aligned around URE participation as a policy objective. This reframes the challenge from "how do we build the infrastructure?" to "how do we coordinate the infrastructure we already have?", with significant implications for the tractability and cost of the proposed intervention.

6.2. Policy Implications For Türkiye

The IUR-Türkiye framework outlines a three-tiered architecture spanning the policy, institutional, and curricular levels. This section does not restate those recommendations but examines the conditions under which they are likely to succeed or fail, drawing on the evidence in Sections 3 and 4 and the comparative cases in Section 6.3.

The most consequential and most contested dimension concerns faculty engagement and mentorship recognition. The TÜDA 2025 finding that fewer than two-thirds of undergraduates report active faculty encouragement is often cited as evidence of insufficient institutional commitment. This figure must be interpreted with caution: as noted in Section 3.3, TÜDA measures perceived encouragement, not actual mentorship practice. The gap between perception and practice has direct implications for the intervention. If the low figure reflects a genuine absence of mentorship, then integrating URE supervision into the Akademik Teşvik Yönetmeliği will likely increase participation by reducing the professional cost of mentoring. If faculty are actively mentoring through BAP and TÜBİTAK projects but students do not perceive this as encouragement, then the barrier is communicative and cultural rather than structural, and incentive reform alone will be insufficient. Indirect support for this latter possibility comes from a qualitative study of faculty at a Turkish university, in which respondents rated financial mechanisms (grants, stipends, and academic incentive payments) as the least influential factor shaping research engagement, identifying teaching load and the availability of time and space as more decisive (Gülbak, 2020). These findings caution that promotion-linked incentives, while necessary, may not by themselves close the participation gap if the binding constraints are workload-related rather than motivational. The policy implication is therefore not simply to reform promotion criteria, as Section 5.3.1.2 proposes, but to design incentive reform alongside institutional communication strategies that make faculty research engagement visible and legible to students.

The curricular embedding dimension, specifically the mandatory integration of at least one CURE into degree requirements, faces a structural trade-off the framework acknowledges but does not fully resolve. International evidence consistently shows that CUREs broaden access to authentic research for large cohorts (Auchincloss et al., 2014; Corwin et al., 2015), but this evidence derives overwhelmingly from STEM laboratory contexts in U.S. universities. The Turkish context presents two complications. First, as the disciplinary asymmetry analysis in Section 4.3.2 reveals, most Turkish undergraduates are enrolled in education faculties and social science

programs, where the laboratory course model is not directly applicable; adapting CURE pedagogy to seminar- and field-based disciplines requires curriculum development investment the framework does not capture. Second, the absence of pedagogical training for CURE facilitation in Turkish faculty development means that mandating CUREs without investing in instructional support risks producing courses that satisfy accreditation requirements without generating authentic inquiry, the compliance theater problem the Indian case in Section 6.3 illustrates.

The equity dimension has the strongest justification in the Turkish data. The existing URE ecosystem is structurally inequitable: TÜBİTAK 2209-A/B participation is academically selective, PURE and KUSRP are competitive, and AdımODTÜ is institutionally bounded. Students at the seventeen non-designated research universities, in non-STEM disciplines, and from lower socioeconomic backgrounds are systematically excluded from all three clusters documented in Section 4.2. The framework's pipeline architecture, from CURE-based mass access through URO-mediated faculty-supervised projects to TÜBİTAK 2209-A/B at the advanced tier, is a structural response to this exclusion that no previous Turkish policy document has operationalized. Its success, however, depends on a condition the framework cannot guarantee: that the ten designated research universities act as institutional role models whose practices diffuse to the broader system. Without explicit YÖK mandates extending URE accountability beyond the research university tier, the equity gap is likely to widen rather than narrow as research universities develop sophisticated URE ecosystems inaccessible to students elsewhere.

These observations converge on a single meta-level implication: IUR-Türkiye is most likely to succeed through coordinated rather than mandated implementation, in which YÖK sets performance expectations and provides incentives, universities retain autonomy over URO structures and CURE curricula, and a national undergraduate research community of practice provides cross-institutional learning. The absence of such a community, analogous to the Council on Undergraduate Research in the U.S. or the British Conference of Undergraduate Research in the UK, is itself a structural gap the framework identifies but does not resolve, and one future policy should address as a precondition rather than a downstream outcome of URE institutionalization.

6.3. Implications Beyond Türkiye

The challenges identified in Türkiye are not unique. They reflect a broader tension that Marginson (2016) identifies as characteristic of systems pursuing research university ambitions within mass higher education: the simultaneous pressure to expand access and concentrate research excellence produces institutional stratification, credential inflation, and the relegation of undergraduates to the consumption rather than production of knowledge. Three cases (India, Brazil, and Indonesia) illustrate how different governance architectures have navigated this tension.

India's experience is the most directly comparable. With over 43 million students across more than 1,000 universities governed by the University Grants Commission (UGC), India confronts the same trilemma of scale, quality, and equity. The UGC's Undergraduate Research Promotion Initiative, launched under the National Education Policy 2020, mandates that Research Universities incorporate undergraduate research into degree structures and report annual participation rates, closely analogous to what IUR-Türkiye proposes for YÖK. The Indian case also illustrates the risks of top-down mandates without faculty incentive reform: Sengupta (2019) documents that compliance often takes the form of pro forma "project submission" requirements that do not meet the international URE threshold. The lesson for Türkiye is clear: the Undergraduate Research Participation Rate metric proposed in Section 5.3.1.1. must be operationally defined with enough specificity to prevent analogous compliance theater.

Brazil's PIBIC, administered by CNPq since 1988 and formalized in 1993 (CNPq, 2024), is the most institutionally mature undergraduate research grant program in the Global South, funding faculty-supervised undergraduate researchers across all federal and state universities with mandatory presentation at an annual national symposium. Two features are directly transferable. First, eligibility to mentor PIBIC students is tied to maintaining active CNPq research grants, aligning undergraduate supervision with faculty career advancement, precisely the logic IUR-Türkiye pursues by integrating mentorship into the Akademik Teşvik Yönetmeliği. Second, its dedicated equity track (PIBIC-Af for underrepresented students) offers a direct model for the framework's Student Access and Progression tier.

Indonesia offers a third lesson through curricular rather than grant-based institutionalization. The 2020 Merdeka Belajar Kampus Merdeka reform (Ministerial Regulation No. 3) requires degree programs to provide structured pathways for project-based and experiential learning, including research, enforced through the BAN-PT accreditation system (Ministry of Education and Culture, Indonesia, 2020). The parallel to the framework's Curricular Embedding dimension is direct: both

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treat the curriculum, rather than the grant program, as the primary vehicle for scaling access, and both rely on accreditation (BAN-PT and YÖKAK) for accountability.

Together, these cases converge on a lesson central to the IUR-Türkiye proposal: the distinction between a policy that enables undergraduate research (grant availability, institutional autonomy, faculty encouragement) and one that institutionalizes it (mandated metrics, accreditation linkage, faculty incentive reform) is the difference between a program for the few and a system for the many. The transfer value of the Turkish case lies in the specificity of its accountability architecture: by embedding a measurable participation metric within YÖK's existing performance evaluation, linking mentorship recognition to promotion regulations, and positioning TÜBİTAK 2209-A/B as the pipeline's advanced tier rather than its entry point, IUR-Türkiye provides a replicable template for systems that share Türkiye's governance characteristics but lack an actionable roadmap. The framework is thus both a local policy proposal and a contribution to the comparative literature on undergraduate research institutionalization in non-Anglophone systems.

6.4. Limitations and Future Directions

Beyond the methodological limitations detailed in Section 3.3, one broader limitation should be acknowledged: IUR-Türkiye is a theoretically grounded proposal, not an empirically validated model, and its effectiveness remains to be demonstrated through implementation studies. Three directions for future research follow.

The first concerns the long-term impact of existing mechanisms. TÜBİTAK 2209-A/B programs have operated for decades, yet no longitudinal study has tracked their effects on graduate persistence, scientific identity, or doctoral pipeline outcomes in Türkiye. Without this evidence, claims about the doctoral pipeline value of competitive URE programs remain inferential. Longitudinal studies comparing TÜBİTAK recipients against matched non-participants would provide the national foundation the framework currently borrows from international studies.

The second concerns scalability across disciplines. As Section 6.2 argues, the CURE model's evidence base is concentrated in STEM laboratory settings, leaving its applicability to the education and social science programs that enroll most Turkish undergraduates an open empirical question. Comparative studies of the learning gains, faculty workload implications, and resource requirements of CURE implementation across these disciplinary contexts are needed before confident system-level prescriptions can be made.

The third concerns institutional dynamics and implementation barriers. The framework proposes structural reforms (centralized UROs, Akademik Teşvik reform, YÖKAK metric integration) that require organizational change at the institutional level, not only policy will at YÖK. The gap between policy adoption and organizational implementation is well documented in higher education reform research, and the Turkish context, with its history of top-down reform and faculty cultures shaped by the current incentive regime, may present resistance patterns the framework does not fully anticipate. Mixed-method implementation studies would provide the grounded evidence needed to refine the institutional tier before system-wide adoption.

6.5. Conclusion

This study set out to address the dual gap analyzed above: the near-total absence of authentic UREs from the national scholarly record, and the failure of YÖK's policy architecture to translate research-excellence ambitions into operationalizable metrics for undergraduate participation. The convergence of the scoping review and the policy document analysis reveals that these gaps are structurally related: without institutional levers that mandate, monitor, and reward URE participation, individual faculty-led or grant-dependent initiatives will continue to constitute the entire national ecosystem, leaving 3.5 million undergraduates largely outside the knowledge-creation mission that research university designation is meant to embody.

The central empirical finding, that only eight of the 76 publications meet the international definition of authentic undergraduate research participation, is self-reinforcing: because policy documents lack URE-specific performance indicators, institutions face no accountability pressure to move beyond attitudinal surveys toward the structured inquiry programs that the international literature associates with gains in critical thinking, disciplinary identity, and graduate-school aspiration. The IUR-Türkiye framework is designed to interrupt this cycle by linking policy mandates, institutional structures, and curricular mechanisms into a coherent system of incentives and accountability.

At the YÖK level, the most consequential single action would be incorporating URE-specific metrics into the existing Research University Performance Evaluation Framework: adding an "Undergraduate Research Participation Rate" indicator, defined as the proportion of undergraduates who complete at least one supervised, credit-bearing inquiry project per academic year, to the

annual reporting cycle. The TÜDA 2025 infrastructure already exists to collect these data at scale; what is missing is the obligation to report it and the lever that makes improvement consequential for funding under the Araştırma Üniversiteleri Destek Programı (ADEP). At the institutional level, establishing centralized Undergraduate Research Offices at each of the ten designated research universities, modeled on PURE and KUSRP, would provide the coordination infrastructure to connect TÜBİTAK 2209-A/B pipelines, BAP funding, and CURE-embedded courses into a coherent student-facing system. At the curricular level, integrating at least one CURE into the degree requirements of every undergraduate program, beginning with disciplines where laboratory or project-based pedagogy is already expected (engineering, natural sciences, health sciences), represents the most scalable entry point for expanding authentic URE access beyond the privileged minority who self-select into competitive scholarships.

Future Research Directions: Three gaps warrant urgent attention. First, the structural causes of the disciplinary asymmetry in Section 4.3.2, particularly the role of YÖK's Academic Incentive Regulation in channeling STEM faculty publishing away from Turkish-language outlets, deserve direct investigation; a faculty survey examining how incentive structures shape pedagogical investment in mentorship across disciplines would provide the causal evidence for targeted reform. Second, the distinction between student perceptions of faculty encouragement (TÜDA 2025, where 56% report feeling encouraged) and actual documented mentorship practice (for which no national data exists) is a critical measurement gap; longitudinal studies comparing perceived and actual mentorship, benchmarked against instruments such as NSSE or Eurostudent, are needed before the 56% figure can be read as evidence of adequate provision. Third, the four institutions operating independent URE programs (Sabancı/PURE, Koç/KUSRP, Bilkent/CS390-490, METU/AdımODTÜ) are natural quasi-experimental sites for studying the long-term outcomes of structured participation on student trajectories, faculty productivity, and institutional visibility; comparative outcome studies across these programs and their matched non-participants would generate the national evidence base that serious policy advocacy requires.

Positioning undergraduate research at the nexus of teaching and policy does not merely transform the educational mission of Türkiye's research universities; it redefines what it means for a university to be research-intensive. The Boyer Commission's foundational insight, that the undergraduate is not an audience for research but a participant in it, remains as generative and as unfinished in Türkiye as it was in the United States in 1998. The IUR-Türkiye framework offered here is one response to that unfinished project: a structured, contextually grounded, and policy-actionable roadmap for embedding authentic undergraduate research as a structural expectation rather than an individual privilege.

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Research Ethics
Not applicable.

Artificial Intelligence Use
The authors state that generative AI tools (e.g., ChatGPT) were used only for language editing during manuscript preparation. No AI-generated content was used for analysis or interpretation. The authors take full responsibility for the integrity and accuracy of the content.

Author Contributions
The authors have accepted responsibility for the entire content of this manuscript and approved its submission.

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Supplementary Table A. Full Corpus of 76 Studies with Disciplinary and URE-Alignment Coding

No.	Reference (Author, Year)	Database	Publication Type	Disciplinary Field	URE-Aligned (1=Yes)
1	Akgün (2012)	TR Dizin	Journal article	Education Sciences	0
2	Akkanat, Kutlu Abu, Çakır & Gökdere (2017)	DergiPark	Journal article	Education Sciences	0
3	Akman, Ergenç, & Çelik (2011)	TR Dizin	Journal article	Health Sciences	0
4	Aksu (2018)	DergiPark	Journal article	Education Sciences	1
5	Anapa (2019)	YÖK Thesis Center	Master's thesis	Education Sciences	1
6	Arısın, Hıdıroğlu, Karavuş, Topuzoğlu, Batman, & Tunç Nakış (2024)	DergiPark	Journal article	Health Sciences	1
7	Ateş (2004)	DergiPark	Journal article	Education Sciences	0
8	Ateş, Dağhan, Ünal, Ünsal, Üzrek & Özyavuz (2023)	TR Dizin	Journal article	Health Sciences	0
9	Avcı, Yenilmez-Türkoğlu & Eş (2020)	DergiPark	Journal article	Education Sciences	0
10	Ayaydın & Kurtuldu (2010)	DergiPark	Journal article	Education Sciences	0
11	Aydemir (2012)	YÖK Thesis Center	Master's thesis	Education Sciences	0
12	Ayyıldız (2021)	DergiPark	Review article	Social Sciences	0
13	Bahadır & Tuncer (2016)	TR Dizin	Journal article	Education Sciences	0
14	Bal (2012)	DergiPark	Journal article	Education Sciences	0
15	Baltacı & Tülek Deniz (2019)	DergiPark	Journal article	Health Sciences	0
16	Baykara (2019)	YÖK Thesis Center	Doctoral thesis	Education Sciences	0
17	Bayra (2024)	DergiPark	Journal article	Education Sciences	0
18	Bilasa & Taşpınar (2019)	TR Dizin	Journal article	Education Sciences	0
19	Bulunuz (2011)	TR Dizin	Journal article	Education Sciences	0
20	Büyüköztürk (1994)	DergiPark	Journal article	Interdisciplinary / Institutional	0
21	Büyüköztürk (1996)	YÖK Thesis Center	Doctoral thesis	Interdisciplinary / Institutional	0
22	Büyüköztürk (1997)	DergiPark	Journal article	Education Sciences	0
23	Çalış, Zengin & Erbay (2022)	DergiPark	Journal article	Social Sciences	0
24	Camuzcu Aşiroğlu (2016)	DergiPark	Journal article	Education Sciences	0
25	Çelik, Önder, Durmaz & Yurdusever (2014)	DergiPark	Journal article	Health Sciences	0
26	Ceyhan (2014)	YÖK Thesis Center	Master's thesis	Education Sciences	0
27	Çoğaltay (2016)	DergiPark	Journal article	Education Sciences	0
28	Dalkılıç (2025)	DergiPark	Journal article	Health Sciences	0
29	Demir (2024)	YÖK Thesis Center	Doctoral thesis	Health Sciences	1
30	Demir & İnanıcı (2024)	TR Dizin	Journal article	Health Sciences	1
31	Dombaycı & Ercan (2017)	DergiPark	Journal article	Education Sciences	0
32	Erol & Alpaydın (2017)	DergiPark	Journal article	Interdisciplinary / Institutional	0
33	Filiz (2004)	DergiPark	Journal article	Social Sciences	0
34	Genç (2025)	YÖK Thesis Center	Doctoral thesis	Education Sciences	0
35	Göksel & Yıldız (2021)	DergiPark	Journal article	Social Sciences	0
36	Gülek Karadüz & Hızlıol (2024)	TR Dizin	Journal article	Health Sciences	0
37	Harman & Şeker (2019)	TR Dizin	Journal article	Education Sciences	0
38	Hiğde & Aktamış (2023)	DergiPark	Journal article	Education Sciences	0
39	İlhan, Çelik, & Aslan (2016)	DergiPark	Journal article	Education Sciences	0
40	Karaibrahimoğlu & Karaoğlu (2018)	TR Dizin	Journal article	Health Sciences	0
41	Karakaya-Özyer (2023)	DergiPark	Journal article	Education Sciences	0

https://doi.org/10.32329/uad.1881510

42	Karamustafaoğlu & Meşeci (2021)	DergiPark	Journal article	Education Sciences	0
43	Kart & Gelbal (2014)	DergiPark	Journal article	Education Sciences	0
44	Kes & Öztürk Şahin (2019)	DergiPark	Journal article	Health Sciences	0
45	Koç, Çalık, Şenel, Aslan, & Zor (2020)	DergiPark	Journal article	Interdisciplinary / Institutional	0
46	Köklü (2000)	DergiPark	Journal article	Education Sciences	0
47	Korkmaz, Şahin, & Yeşil (2011)	DergiPark	Journal article	Education Sciences	0
48	Korkut (2018)	DergiPark	Journal article	Education Sciences	1
49	Koyuncu & Şata (2024)	DergiPark	Journal article	Education Sciences	0
50	Koyunlu-Ünlü (2020)	DergiPark	Journal article	Education Sciences	0
51	Kurt, İzmirli, Fırat & İzmirli (2010)	TR Dizin	Journal article	Education Sciences	0
52	Mandıracıoğlu, Sezer, Batı, & Kaçmaz Başoğlu (2016)	DergiPark	Journal article	Health Sciences	1
53	Peten, Yaman, Sezen Vekli, & Çavuş. (2019)	DergiPark	Journal article	Education Sciences	0
54	Muşlu Kaygısız, Benzer & Dilek Eren (2020)	DergiPark	Journal article	Education Sciences	1
55	Odabaşı, Kuzu, Kuzu & Şahin (2011)	TR Dizin	Journal article	Education Sciences	0
56	Polat (2014)	TR Dizin	Journal article	Education Sciences	0
57	Şahin Kürşad (2015)	TR Dizin	Journal article	Education Sciences	0
58	Semiz (2021)	YÖK Thesis Center	Master's thesis	Education Sciences	0
59	Semiz & Tunç Şahin (2021)	DergiPark	Journal article	Education Sciences	0
60	Şensoy & Yıldırım (2017)	DergiPark	Journal article	Education Sciences	0
61	Sevimli, Özen, Çetin, Tanır, & Tekin Dede (2025)	DergiPark	Journal article	Education Sciences	1
62	Taş, Başoğlu, Sarıgöl & Tepe (2019)	DergiPark	Journal article	Education Sciences	0
63	Taşdemir & Taşdemir (2016)	TR Dizin	Journal article	Education Sciences	0
64	Tuncer & Yılmaz (2016)	TR Dizin	Journal article	Education Sciences	0
65	Türk (2024)	YÖK Thesis Center	Master's thesis	Interdisciplinary / Institutional	0
66	Ünal (2012)	YÖK Thesis Center	Doctoral thesis	Engineering & Natural Sciences	0
67	Ünal & Ekşioğlu (2023)	TR Dizin	Journal article	Health Sciences	0
68	Uysal Toraman, Bayık Temel, Kalkım & Erkin Balyacı (2013)	TR Dizin	Journal article	Health Sciences	0
69	Yapalak & Ilgaz (2013)	TR Dizin	Journal article	Education Sciences	0
70	Yaşar (2014)	DergiPark	Journal article	Education Sciences	0
71	Yavuz (2018)	DergiPark	Journal article	Education Sciences	0
72	Yenice & Özden (2016)	DergiPark	Journal article	Education Sciences	0
73	Yıldırım (2024)	YÖK Thesis Center	Master's thesis	Social Sciences	0
74	Yıldırım, Şahin & Tabaru (2017)	TR Dizin	Journal article	Education Sciences	0
75	Yılmaz, İflazoğlu & Uzelli Yılmaz (2020)	DergiPark	Journal article	Health Sciences	0
76	Yolcu, Er, Metin, & Doğanay (2025)	DergiPark	Journal article	Education Sciences	0

Highlighted rows indicate the nine publications (eight distinct research projects) coded as URE-aligned (score = 1). Demir (2024) and Demir & İnanıcı (2024) derive from the same doctoral project and are counted as one study. Full coding details are available in the accompanying spreadsheet.