# A New Multidimensional Approach to Assess Undergraduate Research Identity: Conceptualization, Measurement and Validation

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*Abstract*

*Undergraduate research fosters critical thinking and independent inquiry, yet many students struggle with engagement due to low confidence, limited recognition, and lack of interest, hindering the development of a strong research identity. This study addresses these challenges by developing and validating the Research Identity Scale (RIS) grounded in Social Cognitive Theory. The RIS assesses three core dimensions: Performance-Competence, Interest, and Recognition. Using a rigorous multi-phase process including item generation, expert review, exploratory factor analysis, and confirmatory factor analysis. Results confirmed strong reliability, validity, and a robust three-factor structure. Findings highlight the interconnected roles of competence, intrinsic motivation, and recognition in shaping research identity. The RIS offers educators and policymakers a tool to assess and support students' research identity development, promoting interventions that enhance engagement and foster belonging. The study emphasizes the need for research-rich environments that cultivate confidence, motivation, and self-recognition in undergraduate researchers.*

*Keywords: Research Identity, Scale Development, Social Cognitive Theory, Structural Equation Modeling.*

## 1. Introduction

Undergraduate research is widely regarded as a transformative educational practice that cultivates critical thinking, creativity, and independent inquiry (Yuan et.al.2020). Despite its recognized value, many students struggle to engage meaningfully in research due to low confidence, limited recognition, and lack of sustained interest (Adi Badiozaman, Ling, & Ng, 2024). These barriers hinder not only their immediate participation but also the development of a coherent research identity a vital psychological and professional construct that influences long-term academic engagement.

Research identity refers to how individuals perceive themselves as researchers how confident they feel in their abilities, how invested they are in research activities, and how recognized they feel by the academic community (Lapum, 2008; Çakmak & Çelik, 2024). It is not static; rather, it evolves over time through dynamic interactions between the individual and their academic environment (Avraamidou, 2020). Rooted in broader understandings of identity as fluid and sociocultural, research identity encompasses beliefs, values, behaviors, and social experiences that collectively shape one's self-concept as a scholar (Castelló et al., 2021).

Drawing from Social Cognitive Theory (SCT), three core dimensions emerge as central to research identity: performance-competence, interest, and recognition. Performance-competence relates to self-efficacy and perceived ability to conduct research successfully (Bandura, 1997). Interest reflects intrinsic motivation and curiosity that sustain long-term engagement (Ryan & Deci, 2000). Recognition involves external validation from peers, mentors, and institutions essential for fostering a sense of belonging within the research community (Kamler & Thomson, 2014). Together, these dimensions interact to influence students' willingness to persist, take intellectual risks, and envision themselves as future researchers.

While existing tools often assess isolated aspects of research identity such as motivation or confidence there remains a lack of comprehensive, multidimensional instruments that capture the full scope of identity formation, especially at the undergraduate level. To address this gap, the present study introduces and validates the Research Identity Scale (RIS). Grounded in SCT and informed by extensive theoretical and empirical literature, the RIS aims to provide a robust framework for assessing the developmental pathways of research identity among undergraduate students. Through this study, we seek to answer the following research question:

RQ1: What are the key factors that contribute to the development of research identity among undergraduate students?

## 2. Research Methodology

The study used a structured scale development methodology, following a three-stage process that included item generation, exploratory and confirmatory factor analyses (EFA & CFA), and reliability and validity testing, based on established frameworks (DeVellis & Thorpe, 2021; Sultana and Farooq, 2024). The process was organized into three key stages to ensure theoretical robustness, empirical accuracy, and practical applicability of the Research Identity Scale. The stages are Stage 1: Item Generation and Selection- Development of the initial item pool based on literature review and expert evaluation. Stage 2: Scale Refinement- Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) to validate the scale structure. Stage 3: Scale Evaluation- Reliability and validity assessment using various psychometric criteria. Each stage was carefully designed to ensure theoretical robustness, empirical accuracy, and practical applicability of the developed scale. The details of each stage are as follows:

## 3.1. Stage 1: Item Generation and Selection

### 3.1.1. Item Generation

The Research Identity Scale (RIS) was developed through a thorough literature review on identity-related constructs in research engagement, deriving many items from the Research Skill Development (RSD) framework (Cutillas et al., 2023). An initial set of 51 items was created, followed by content validation using the Delphi method with a panel of eight experts in education, research methodology, and scale development. Items were rated for clarity, relevance, and theoretical alignment, retaining those with a Content Validity Index (CVI) of 0.80 or higher, resulting in 38 items. A pilot study with 30 research interns was conducted to ensure clarity and relevance for undergraduate students, yielding qualitative feedback for further refinements. The final validated item set consisted of 35 items, ready for factor analysis and scale validation.

## 3.2. Stage 2: Scale Refinement

### 3.2.1. Data Collection and Sampling Strategy

A total of 428 responses were collected from undergraduate students. After removing duplicates, incomplete responses, and inattentive entries, a final sample of 333 valid responses was used for analysis. A purposive sampling technique was employed, ensuring the inclusion of students actively engaged in research across diverse academic disciplines. Participation was voluntary, and informed consent was obtained. The study was approved by the Institutional Review Board (IRB) of University.

### 3.2.2. Exploratory Factor Analysis (EFA)

To determine the factor structure of the RIS, we performed Exploratory Factor Analysis (EFA) using IBM SPSS (v.29). The Kaiser-Meyer-Olkin (KMO) score was 0.834, and Bartlett's Test indicated significance ($p < 0.05$). We utilized Principal Component Analysis (PCA) with Varimax Rotation, removing items with factor loadings below 0.40 and cross-loading items. This resulted in a final three-factor structure: Performance-Competence (7 items), Interest (6 items), and Recognition (6 items), explaining 64.2% of the total variance and confirming the scale's validity.

### 3.2.3. Confirmatory Factor Analysis (CFA)

To validate the factor structure identified in EFA, Confirmatory Factor Analysis (CFA) was conducted using IBM AMOS (v.29). The results confirmed that the three-factor model provided a statistically valid representation of research identity. (Table 2.)

**Table 1: Summary of items, factor loading, and factors that emerged in Exploratory factor analysis of the Research Identity Scale (RIS)**

| Factors | Items | Loading |
|---|---|---|
| Performance- Competence | PC 01_I can confidently deliver research presentations. | .821 |
| | PC 02_I know how to develop and collect data through surveys. | .799 |
| | PC 03_ I can write research papers to communicate my research findings. | .744 |
| | PC 04_I can communicate my research findings with team members. | .735 |
| | PC 05_I can manage and organize data. | .727 |
| | PC 06_I can interpret data graphics etc. from scientific articles. | .647 |
| | PC 07_I cannot collect data using different sampling techniques. | .602 |
| Recognition | R 01_I don't have a scientific mindset. | .841 |
| | R 02_I find it difficult to connect scientific research with societal values. | .816 |
| | R 03_ I do not feel confident in my research skills. | .815 |
| | R 04_I do not feel responsible for contributing to the scientific community. | .719 |
| Interest | I 01_I rarely feel curious about exploring new research topics. | .806 |
| | I 02_I perceive challenging research as an opportunity to grow and learn. | .758 |
| | I 03_I H motivated to clarify research questions. | .568 |
| Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser; Normalization. Rotation converged in 4 iterations. | | |

**Table 2. Model Fit Indices of Research Identity Scale (RIS)**

| Fit Index | Recommended Value | CFA Model Value |
|---|---|---|
| $\chi^2$/df (CMIN/df) | < 5.00 | 1.849 |
| Comparative Fit Index (CFI) | > 0.90 | 0.975 |
| Goodness of Fit Index (GFI) | > 0.90 | 0.968 |
| Incremental Fit Index (IFI) | > 0.90 | 0.965 |
| Tucker-Lewis Index (TLI) | > 0.90 | 0.945 |
| Root Mean Square Error of Approximation (RMSEA) | < 0.08 | 0.051 |

## 3.3. Stage 3: Scale Evaluation

### 3.3.1. Reliability Testing

The internal consistency of the RIS was evaluated using Cronbach's alpha ($\alpha$) and the Composite Reliability Index (CRI), both showing good reliability. Convergent validity was confirmed with an Average Variance Extracted (AVE) greater than 0.50, while discriminant validity was established by ensuring inter-factor correlations stayed below 0.85.

**Table 3: Reliability statistics for dimensions of Research Identity Scale**

| Factor | Number of Items | Cronbach's Alpha (α) | Composite Reliability (CR) |
|---|---|---|---|
| Performance- | 7 | 0.833 | 0.875 |
| Competence | 6 | 0.760 | 0.812 |
| Interest | 6 | 0.710 | 0.793 |

*Note: A Cronbach's alpha > 0.70 confirmed the scale's internal reliability*

Further, nomological validity of the Research Identity Scale (RIS) was assessed by examining its relationship with Research Motivation (ReMotv), an established construct in research engagement. Research motivation was measured using a three-item scale adapted from Yee and Lai (2021) and incorporated into the second section of the questionnaire. Participants rated each item on a five-point Likert scale, allowing for a standardized assessment of motivation levels. To evaluate the nomological network, research motivation was integrated into the Research Identity SEM model, testing its theoretical alignment with the RIS dimensions: Performance-Competence, Recognition, and Interest (Figure 1). The results revealed a positive correlation (r = 0.64) between Research Motivation and Research Identity, indicating that higher motivation is associated with a stronger research identity. The path coefficients further supported this relationship, demonstrating significant contributions of Research Motivation (0.64). This validation reinforces the theoretical and practical significance of the RIS, highlighting its ability to capture essential constructs related to undergraduate research engagement.

## 3. Discussion

The present study aimed to develop and validate the Research Identity Scale (RIS) to assess undergraduate students' research identity. The findings confirmed that research identity is a multidimensional construct, composed of three key dimensions: Performance-Competence, Interest, and Recognition. These dimensions align with the theoretical underpinnings of Self-Determination Theory (SDT), Social Cognitive Theory (SCT), and Self-Perception Theory (SPT), reinforcing the argument that research identity is shaped by intrinsic motivation, perceived competence, and social recognition.

The results of Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) confirmed that the three-factor structure provided a valid and reliable representation of research identity, with acceptable model fit indices across multiple psychometric assessments. Additionally, Structural Equation Modeling (SEM) validated the theoretical relationships among the three dimensions, indicating that competence, interest, and recognition collectively contribute to the formation of a strong research identity.
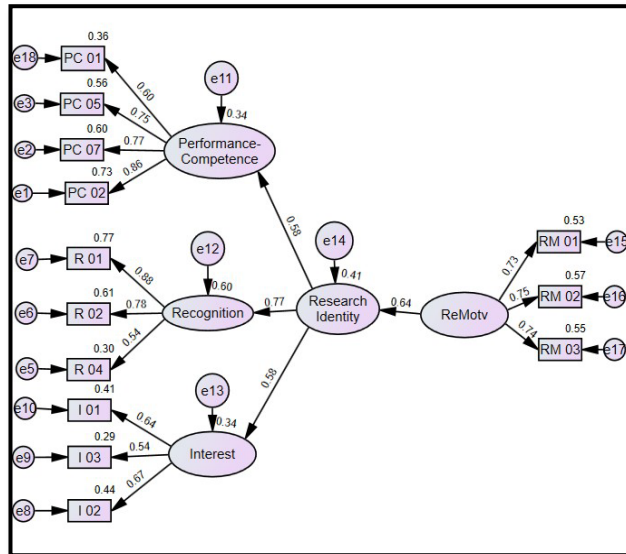
*Figure 1: Structural Equation Model to assess the nomological validity of Research Identity with Research Motivation*

Importantly, the validated RIS has significant practical utility in higher education settings. It can be employed by academic advisors, research coordinators, and educators to identify students with strong or developing research identities, enabling targeted mentoring and research opportunities. Institutions may integrate this scale into undergraduate research programs or workshops to assess baseline levels of research engagement and monitor growth over time. Furthermore, by recognizing and supporting students' competence and interest in research, universities can foster a culture that encourages scientific inquiry and early research involvement thereby promoting undergraduate scientific research in a more structured and evidence-based manner.

## 4. Future Research Directions

The findings of the present study provide a strong foundation for understanding undergraduate research identity however, several areas require further exploration. First, longitudinal studies are needed to examine how research identity evolves over time. Tracking students' research identity across different academic years and into graduate studies will offer deeper insights into the long-term impact of research engagement and how identity formation shifts throughout an academic career. Second, cross-cultural validation of the Research Identity Scale (RIS) is essential. Since this study was conducted within a single institutional setting, future research should test the scale across diverse cultural, educational, and institutional contexts to assess its generalizability and applicability in different learning environments. Third, a mixed-methods approach would provide a more comprehensive understanding of research identity formation.

Incorporating qualitative methods such as in-depth interviews, focus groups, and longitudinal case studies alongside quantitative assessments can offer richer insights into the personal and contextual factors shaping students' research identity. By addressing these areas, future research can deepen our understanding of the mechanisms that shape research identity and contribute to the development of targeted interventions that foster a stronger research culture in higher education.

## 5. Conclusion

The Research Identity Scale (RIS) developed in this study offers a validated framework to assess research identity among undergraduate students. The findings highlight key factors such as perceived competence, intrinsic interest, and recognition from peers and faculty in shaping research identity. This emphasizes the need for institutions to adopt strategies to enhance research engagement. The study provides a measurement tool for assessing research identity and insights for fostering a culture that values research in higher education. In practical terms, the RIS can be incorporated into student development initiatives to identify and nurture research potential. Its application can inform the design of targeted programs that promote undergraduate scientific research across diverse academic disciplines. By addressing these aspects, educational institutions can better support students as active contributors to research, enriching the academic community and improving the educational experience.

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