A multidimensional framework for understanding career disinterest in software testing: A cultural, economic, and curriculum-based review

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ABSTRACT

The aim of this research is to examine the global lack of interest in software testing careers among IT students and to propose culturally grounded reforms for the Philippine context. Although demand for software testing professionals continues to grow, students in many countries perceive testing as repetitive, low in prestige, and limited in career progression. This narrative review uses thematic synthesis to analyze peer-reviewed studies published between 2013 and 2024 from Pakistan, Brazil, India, China, Norway, the United Kingdom, and the United States. The findings identify three key factors influencing career reluctance: cultural influences, economic considerations, and curriculum-related gaps. In the Philippines, cultural values such as utang na loob (debt of gratitude) and pakikisama (group harmony) play an important role in shaping career choices, often discouraging interest in software testing roles. Based on these findings, the study proposes the Cultural–Economic–Curriculum Influences on Reluctance Testing Careers (CEC-IRTC) framework to support curriculum reform, industry–academe collaboration, and culturally sensitive career guidance. Further empirical research is recommended to inform policy and educational practice.

1. Introduction

The global digital transformation has increased the demand for quality assurance in software systems, making software testing an essential component of modern IT infrastructure. As organizations increasingly rely on digital platforms for critical operations, the role of software testing professionals has become dominant in safeguarding business continuity, protecting sensitive data, and ensuring user satisfaction. However, despite the growing market demand and competitive salaries in the testing domain, a concerning paradox emerges:

IT students consistently demonstrate reluctance to pursue software testing as a career path. This trend is particularly pronounced in the Philippines, where the booming IT-Business Process Outsourcing (BPO) industry generates substantial revenue and employs hundreds of thousands of professionals, yet faces potential talent shortages in quality assurance roles.

The Philippine context presents unique challenges that warrant specialized investigation beyond existing international research frameworks. As a nation where family-oriented decision-making, collective achievement, and social harmony (pakikisama) profoundly influence career trajectories, Filipino IT students' professional choices cannot be understood through Western-centric models alone. Furthermore, the country's education system, characterized by coding-intensive curricula and development-focused pedagogical approaches, may unconsciously marginalize testing disciplines. This study addresses the critical knowledge gap by investigating Filipino IT students'

career interest patterns through a culturally sensitive lens, employing a narrative review with thematic synthesis to examine how cultural values, economic considerations, and educational experiences intersect to shape career perceptions across diverse research contexts. The findings will inform evidence-based strategies for cultivating a strong pipeline of software testing professionals essential for sustaining the Philippines' competitive advantage in the global IT marketplace.

This paper is organized into seven main sections. The Introduction outlines the background and motivation of the study. Section 2 presents the Literature Review, analysing prior research and identifying the knowledge gaps that inform this work. Section 3 explains the Review Methodology, highlighting the procedures adopted to ensure rigor and reliability. Section 4 introduces the Contextualized Framework: The CEC-IRTC Model, which forms the core contribution of the study. Section 5 provides a detailed discussion of the framework and its implications. Section 6 highlights the Practical Implications, translating theoretical insights into actionable recommendations. Finally, Section 7 offers a Conclusion and Future Work, summarizing the main contributions and suggesting directions for further investigation.

2. Literature review

Several international studies have consistently documented negative perceptions toward software testing careers among computing students. Initially, Deak et al. (2013) conducted pioneering research in Norway, revealing that students perceived testing as less creative and intellectually stimulating compared to development roles. Building upon this foundation, Fernando Capretz et al. (2021) expanded this research across Canada, India, China, Malaysia, the UAE, and Pakistan, demonstrating that negative perceptions transcend geographical boundaries while identifying common psychological factors contributing to testing disinterest.

Furthermore, Quinlan and Renninger (2022) reinforced these findings through a systematic analysis of computer science curricula, showing how inadequate testing education perpetuates negative career perceptions. Their work highlighted curriculum design's critical role in shaping professional aspirations. Additionally, prior research by Fernando Capretz et al. (2021) and Deak et al. (2013) identified key psychological factors underlying testing disinterest: perceptions of testing as less prestigious than development, requiring fewer technical skills, offering limited career progression, and being repetitive.

Moreover, Koçak et al. (2022) examined how early educational experiences shape career preferences, demonstrating that students' first exposure to testing concepts significantly influences their willingness to consider testing careers. Similarly, Asok Kumar et al. (2024) explored how cultural values influence IT career choices in Southeast Asian contexts, highlighting family expectations and societal prestige in decision-making. However, their work did not address software testing careers or Philippine cultural dynamics. Likewise, Kankanhalli et al. (2004) examined cross-cultural differences in system developers but lacked focus on testing careers and Philippine contexts.

Factors such as educational, cultural, societal, and curriculum design elements play a particularly relevant roleplays a particularly relevant role in the Philippines, a global outsourcing hub with a thriving Information Technology (IT) sector. Despite the country's strong position in the global IT market, many Filipino IT students continue to avoid testing roles. Contributing factors include unique cultural values such as pakikisama (group harmony) and utang na loob (debt of gratitude), which subtly shape educational and career decisions.

Consequently, existing research lacks deep contextualization within the Philippine setting. While international studies provide valuable insights into disinterest in testing careers, none have adequately examined how Filipino cultural values, educational systems, and societal expectations specifically influence software testing career perceptions. This lack of localized insight significantly limits the applicability of international findings to the unique dynamics of the Philippines.

Therefore, the purpose of this review is to synthesize international research on software testing career perceptions and to identify culturally grounded reform strategies within the Filipino context. By comparing global trends with localized insights, this paper seeks to inform culturally relevant strategies that can help reposition testing as a desirable career path for Filipino IT students, addressing the critical need for culturally integrated frameworks in software testing career development.

3. Methodology

This study utilized a narrative review with thematic synthesis, adhering to the guidelines established by Pasha and Siddiqui (2020) for synthesizing findings from studies with heterogeneous designs. The narrative review approach was selected over a systematic review due to the exploratory nature of the research question. The primary research inquiry driving this investigation was: How do cultural, economic, and curricular factors influence Filipino IT students' reluctance to pursue careers in software testing, and what culturally informed reforms could be implemented to address this disinterest?

To support this main inquiry, four specific research questions were developed to explore: (1) the common factors contributing to disinterest in software testing careers among IT students globally, (2) the specific impact of Filipino cultural values, such as utang na loob and pakikisama, on career decision-making in software testing, (3) the curriculum gaps present in Philippine higher

education institutions regarding software testing education, and (4) how international research findings on career perceptions in testing can be adapted to fit the Philippine cultural and educational context.

3.1. Review process: A four-phase systematic approach

The literature review followed a systematic four-phase process designed to ensure comprehensive coverage and methodological rigor. The first phase focused on identification and search strategy, the second on screening and selection, the third on data extraction, and the fourth on thematic synthesis and comparative analysis. This structured approach enabled transparent documentation of the review process while maintaining flexibility for narrative synthesis of diverse study designs.

Phase 1: Identification and search strategy: A comprehensive literature search was conducted across five major academic databases (IEEE Xplore, ACM Digital Library, ScienceDirect, SpringerLink, and ERIC) using Boolean search strings that combined career concepts ("software testing career," "quality assurance career"), student populations ("student*," "undergraduate*"), and decision factors ("career choice*," "perception*," "attitude*," "barrier*"), with an example search string: ("software testing" OR "quality assurance" OR "QA testing") AND ("career" OR "profession") AND ("student*" OR "undergraduate*") AND ("perception*" OR "attitude*" OR "motivation*" OR "barrier*"). Secondary searches employed alternative terminology such as "software tester image" and "testing stigma" to ensure comprehensive coverage across diverse conceptual frameworks. The geographic scope was limited to seven countries representing diverse cultural, economic, and educational contexts: Pakistan, Brazil, India, China, Norway, the United Kingdom, and the United States, strategically selected to enable meaningful cross-cultural comparisons relevant to the Philippine educational setting, with the initial database searches yielding 247 articles for subsequent screening.

Phase 2: Screening and selection: The screening phase employed explicit inclusion criteria requiring peer-reviewed empirical research (January 2013-December 2024) focusing on undergraduate IT/Computer Science students' attitudes toward software testing careers, with minimum sample sizes of 30 participants, published in English within the seven target countries, while exclusion criteria systematically eliminated non-peer-reviewed publications, studies focusing solely on professional testers, purely technical studies without career insights, studies with inadequate sample sizes, and those outside the geographic or temporal scope. The screening process proceeded through multiple stages: After removing 43 duplicates from the initial 247 articles, title and abstract screening of 204 unique articles excluded 156 irrelevant studies, leaving 48 for full-text review; during full-text assessment, 43 additional articles were excluded due to insufficient data (n=18), wrong focus (n=12), or methodological issues (n=13), resulting in a final sample of five studies that met all inclusion criteria and provided sufficient quality and relevance for thematic synthesis.

Phase 3: Data extraction: A standardized data extraction form was developed to systematically capture key information from each selected study across six categories: study characteristics (authors, year, country, research objectives), sample information (size, demographics, academic level, discipline), methodological details (research design, data collection methods, analytical approaches), key findings (career barriers, motivators, perceptions, cultural factors), theoretical frameworks (underlying theories or models), and implications (recommendations for education or industry). This structured extraction process, conducted by the primary researcher and organized in tabular format, enabled systematic comparison across studies while preserving unique contextual details, ensuring that all relevant information was captured consistently to provide a solid foundation for the subsequent thematic synthesis.

Phase 4: Summary of Included Studies: This narrative review synthesized findings from five empirical studies (2013-2022) across six countries, employing diverse methodological approaches including cross-national surveys, qualitative interviews, and mixed methods designs with sample sizes ranging from 32 to several hundred participants. The studies examined both universal barriers (curriculum gaps, professional image concerns, role misconceptions) and context-specific influences (cultural values, educational systems, labour market conditions) affecting IT students' interest in software testing careers, with Table 1 systematically presenting each study's characteristics and findings to address factors shaping Filipino IT students' career decision-making.

Table 1 outlines essential methodological considerations for career research in the Philippines. Survey-based approaches, Fernando Capretz et al. (2021) and Deak et al. (2013), necessitate geographical expansion across various Philippine regions and translation into major Filipino languages to encompass diverse cultural perspectives. The focus on individual motivations in these studies should be expanded to include Filipino-specific factors such as opportunities for overseas employment, family financial responsibilities, and the influence of peers on career decisions. Additionally, focus group methodology (Shoffner et al., 2015) requires adaptation to address the conformity bias prevalent in Filipino culture, which may involve using hypothetical scenarios and paying careful attention to family expectations regarding career choices. Questionnaire methods (Souza et al., 2022) must also incorporate contextual elements from local industries, especially considering the growing IT outsourcing sector and internship

partnerships in the Philippines. Mixed-methods research (Quinlan and Renninger, 2022) presents the most comprehensive approach, but it should involve collaboration with Philippine universities to ensure cultural relevance and proper sampling representation. These methodological adaptations are essential for effectively capturing the unique factors that influence career decision-making among Filipino students in their specific cultural, economic, and educational contexts.

Table 1: Comparative synthesis of reviewed studies aligned with CEC-IRTC pillars

Reference	Country	Sample	Methodology	Cultural/social factors	Economic factors
Souza et al. (2022)	Brazil, Canada,	University CS/IT students (large multi-country sample)	Cross-country survey and replication	Low social prestige of testing	Limited perceived career growth
Shoffner et al. (2015)	USA	32 middle-school students	Qualitative interviews	Strong social influence in career formation	Career outcome expectations shape decisions
Deak et al. (2013)	Norway	161 university students	Survey and qualitative analysis	Testing viewed as second-class work	Limited career advancement perception
Capretz and Gilal (2022)	Canada, China, India, Malaysia	Undergraduate CS/SE students	Cross-national survey	National-cultural differences in prestige	Motivation linked to perceived opportunity
Quinlan and Renninger (2022)	United Kingdom	Undergraduate students	Mixed-methods	Career planning shaped by social context	Employability concerns influence choices

3.2. Thematic review and comparative synthesis

The thematic analysis process began with detailed line-by-line coding of findings sections from each included study, generating 47 initial codes that identified discrete concepts related to career decision-making factors in software testing. Each code remained closely connected to the original data while maintaining sufficient abstraction to enable meaningful cross-study comparison, such as coding students' perceptions of testing as merely checking code as "misconception of tester role," views of testing as second-class positions as "low professional status," inadequate testing content as "curriculum inadequacy," and perceptions of testers as critics as "social stigma." These 47 initial codes were subsequently organized into three descriptive themes based on conceptual similarity: "Professional Image and Status" grouped codes related to low professional status, second-class role perception, lack of prestige, social stigma, and perceptions of boring work; "Educational Preparation" consolidated codes concerning curriculum inadequacy, limited testing exposure, lack of hands-on experience, insufficient theory-practice integration, and absence of industry partnerships; and "Career Advancement Concerns" brought together codes addressing limited growth opportunities, unstable career paths, lower salary expectations, reduced technical development, and narrow specialization concerns.

The descriptive themes were then synthesized into three overarching analytical themes that directly addressed the research questions and provided deeper theoretical insights. "Perceptual Barriers to Testing Careers" integrated findings on professional image, role misconceptions, and social stigma to explain common factors contributing to global disinterest in software testing careers. "Structural and Curricular Gaps" synthesized findings about educational preparation, industry exposure, and practical training to address systemic deficiencies in higher education programs. "Cultural Influences on Career Decision-Making" integrated findings about national context, family expectations, and peer influence to reveal how collectivist values, social status hierarchies, and family obligations interact with individual career preferences across different cultural contexts. This final analytical stage enabled comparative analysis that distinguished universal factors, such as curriculum inadequacy and limited practical exposure, from culturally-specific patterns, notably that Western contexts emphasized testing as boring and less creative while Asian contexts highlighted "second-class" status concerns, Western curricula lacked practical exposure while Asian curricula were theory-heavy with minimal industry connections, and Western students prioritized individual autonomy while Asian students showed stronger responsiveness to family expectations and social status considerations, providing insights particularly relevant for understanding barriers facing Filipino IT students within their collectivist cultural context.

A critical methodological evaluation of the included studies was conducted to assess their strengths, limitations, and applicability to the Philippine context, identifying specific adaptations necessary for culturally informed research with Filipino IT students, as summarized in Table 2.

Cultural dimensions of career decision-making: Career decision-making in collectivist societies operates through fundamentally different mechanisms than in Western individualistic contexts. Across Pakistan, China, India, Brazil, and the Philippines, family influence dominates career trajectory formation (Pasha and Siddiqui, 2020). This pattern contrasts with Western contexts in which personal interests and intrinsic motivation guide career choices (Quinlan and Renninger, 2022). The divergence reflects deeper cultural orientations toward individual versus collective welfare maximization. Professional prestige perception compounds familial influence across cultures. International studies consistently document software testing as lower-status work compared to development roles (Fernando Capretz et al., 2021; Shoffner et al., 2015; Souza et al., 2022). Brazilian, Norwegian, and Pakistani students perceive testing as socially isolating, intellectually unchallenging, and lacking professional visibility. This prestige deficit creates self-reinforcing cycles wherein family discouragement further diminishes the field's social

standing. The Philippine context amplifies these collectivist patterns through culturally specific values. *Utang na loob*—the obligation to repay debts of gratitude—significantly influences career trajectories by motivating students toward careers providing immediate family stability, often at the expense of personal growth or professional exploration (Donato et al., 2023). Similarly, pakikisama—the value of group harmony and social acceptance—steers individuals toward professions garnering collective approval (Zialcita, 2020). When software testing lacks social visibility and familial endorsement, these cultural values actively discourage field exploration.

Table 2: Methodological evaluation and contextual adaptation for the Philippine setting

Study	Research design	Methodological strengths	Key limitations	Cultural adaptation required	Economic adaptation required	Curricular adaptation required
Capretz and Gilal (2022)	Survey with open-ended responses	Provides cross-national comparison of testing perceptions	Limited geographical representation	Include Filipino collectivist values such as utang na loob and pakikisama	Address overseas employment motivations and family financial responsibility	Expand to multiple Philippine universities and regions
Deak et al. (2013)	Survey and qualitative analysis	Rich insights into motivational factors	Small national sample	Examine family expectations and peer influence	Incorporate salary perception and job stability concerns	Assess exposure to testing specialization in local curricula
Shoffner et al. (2015)	Focus group discussion	Deep exploration of early career attitudes	Conformity bias and younger age group	Control for conformity bias using hypothetical scenarios	Examine parental expectations in financially constrained households	Focus on university-level IT students rather than adolescents
Souza et al. (2022)	Cross-country questionnaire	Replicable methodology across countries	Limited contextual depth	Incorporate local industry perceptions and social prestige factors	Evaluate awareness of outsourcing and testing demand	Include industry partnership exposure in Philippine programs
Quinlan and Renninger (2022)	Mixed-methods	Integrates quantitative and qualitative insights	Small qualitative subsample	Tailor interviews to Filipino collectivist norms	Assess employability perceptions within Philippine IT labor market	Partner with local universities to reflect curriculum structure

Empirical evidence confirms parental influence as paramount in Philippine career decisions. Digamon and De La Peña (2021) identified parents as the primary influential factor, while Lalantacon et al. (2024) demonstrated how parental involvement shapes interests and values from childhood. Alampay (2024) documented the collectivist nature prioritizing family and peer relationships over individual aspirations, while Nazareno et al. (2021) found rural students with economic constraints gravitate toward vocational training rather than exploratory career paths. Filipino students' preference for "scientific" and socially prestigious courses is reinforced through CHED "in-demand" scholarships, positioning software testing as structurally disadvantaged despite its critical industry role.

Economic dimensions and career motivation: Economic considerations intersect with cultural values to produce divergent career motivation patterns across contexts. In individualistic societies like Australia, self-motivation drives career exploration, though limited exposure to testing roles creates disinterest rooted in awareness gaps rather than cultural barriers. Western contexts demonstrate that resource access significantly impacts specialized field exploration (Akosah-Twumasi et al., 2018).

In collectivist societies, economic motivations intertwine inseparably with family obligations. Indian students link success to career progress and upward mobility (Ray et al., 2020; Thomas et al., 2024), deprioritizing software testing due to perceived limited advancement opportunities. Chinese students view testing as insufficiently intellectually stimulating to meet parental expectations for careers, justifying educational investments. Brazilian contexts reveal similar conflicts where testing contradicts cultural ideals about professional status (Vautero et al., 2021).

For Filipino students, economic considerations operate through family welfare lenses rather than individual advancement frameworks. Software testing faces perception problems regarding income potential and stability, critical factors in developing economies in which family financial support spans generations. Students evaluate IT careers through social mobility potential, but testing's lower visibility compared to development roles obscures comparable salary ranges and career progression opportunities. Resource access disparities compound these perceptions: Rural students facing economic constraints prioritize immediate employment over exploratory career decisions (Nazareno et al., 2021). Without visible successful models in software testing careers, students default to socially validated paths. The absence of career guidance resources addressing testing career economics perpetuates compensation and advancement misconceptions.

Curricular dimensions and structural gaps: Systematic curriculum gaps across countries reveal how educational systems fail to prepare students for testing careers. Pakistan, Norway, and Brazil lack dedicated software testing subjects in standard IT curricula (Fernando Capretz et al., 2021; Deak et al., 2013; Shoffner et al., 2015). This absence signals testing's diminished professional value, when institutions devote minimal curricular time to testing while emphasizing development, students internalize hierarchies devaluing testing's importance. Pakistani students consequently view testing as non-viable; Norwegian students undervalue it after brief coverage without

specialization; Brazilian students develop limited interest from minimal practical exposure.

Even curricula including testing coverage demonstrate substantial gaps between taught content and industry requirements. Modern industry demands expertise in Agile development, CI/CD pipelines, test automation tools, security testing, and comprehensive software quality assurance, topics that most curricula address superficially. This misalignment appears across multiple domains: Agile development receives inadequate coverage despite global industry adoption; software testing lacks standalone courses with hands-on training; CI/CD pipeline integration remains absent or minimal; test automation tools like Selenium receive insufficient practical instruction; security testing lacks specialized training despite growing cybersecurity demands.

The Philippine IT curriculum exhibits parallel structural gaps. CHED guidelines emphasize program design, debugging, and implementation without corresponding testing emphasis. Specific requirements focus on object-oriented programming and software engineering principles but lack dedicated software quality assurance laboratories, modern testing tools, or CI/CD pipeline training. Specialized areas, including AI/ML, cybersecurity, data science, and IoT, omit corresponding testing modules despite these domains requiring sophisticated testing expertise. Internship requirements aim to bridge classroom knowledge with real-world application, but provide insufficient career guidance for testing roles. Without intentional industry partnerships focused on testing placements, students complete internships, and reinforcing development-centric IT career views.

The timing of career exposure compounds these curricular gaps. High school students make career decisions predominantly based on parental preferences and gender stereotypes (Chen et al., 2021; Hadiyati and Astuti, 2023). University students shift toward personal preferences but remain heavily influenced by peer mentorship, income considerations, and parental input (Sharif et al., 2019; Kankanhalli et al., 2004). Internships provide self-discovery opportunities through real-world experience (Rothman and Sisman, 2016; Wei et al., 2021), but by this stage, many students have committed to development-focused paths. This progression suggests interventions must occur early and continuously throughout the educational pipeline to counteract software testing's cumulative disadvantage relative to development careers.

Reform strategies and implementation challenges: International reform initiatives provide evidence for addressing multidimensional barriers. Gothenburg University's dedicated Software QA modules elevated testing from supplementary to core curriculum content. Germany's dual vocational training model, integrating industry mentors, improved practical skills and employer satisfaction. Australian and New Zealand project-based learning initiatives stimulated professional engineering practice through authentic experiences. Australia's Work Integrated Learning programs increased graduate employability through structured internship pipelines, while New Zealand's continuous curriculum review processes improved student performance through collaborative feedback mechanisms (University of Otago model).

Applied to the Philippine context, these reforms suggest specific interventions across the CHED curriculum sections. Integrating real-world testing scenarios could increase course enrollment; laboratory-based SQA instruction with test automation exposure could improve graduate employability through industry-ready skills; specialized testing training across AI, cybersecurity, and data science domains could increase specialized role placement; strengthened internship programs and industry partnerships could expand placement opportunities. However, these projections assume systematic implementation across all dimensions. Curriculum changes alone cannot overcome cultural prestige barriers without family engagement programs demonstrating testing's economic viability and social contribution. Economic incentives like testing specialization scholarships prove insufficient without a corresponding curriculum providing technical foundations and cultural messaging validating testing as prestigious work.

Reform implementation confronts systematic barriers across policy, structural, and operational levels. Faculty skill gaps represent primary operational barriers—instructors cannot teach modern testing practices without professional development in contemporary tools and methodologies. Structural barriers include limited curriculum flexibility addressable through outcome-based education frameworks, outdated infrastructure requiring public-private partnerships, and weak industry-academia linkages necessitating advisory boards and incentivized collaborations. Digital learning tool gaps demand government-led initiatives. Policy-level barriers include rigid accreditation standards requiring comprehensive review processes, while social-structural barriers like gender disparity necessitate targeted interventions. The Philippine context exhibits multiple overlapping barriers. Faculty limitations, infrastructure gaps, weak industry-academia connections, and rigid CHED accreditation processes collectively impede reform. Successfully addressing software testing career reluctance requires coordinated interventions across cultural reframing through family engagement and prestige elevation, economic demonstration through visible career pathways and compensation transparency, and curricular transformation through dedicated testing courses, modern tools, and industry partnerships.

## 4. Contextualized framework: The CEC-IRTC model

The Cultural-Economic-Curriculum Influences on Reluctance Testing Careers (CEC-IRTC) framework

addresses a critical research gap in understanding career-choice patterns among IT students in developing nations, particularly in the Philippines. While existing studies predominantly examine broad global patterns, they overlook the specific regional factors that influence career decisions in these contexts. This framework represents what may be the first comprehensive synthesis of existing literature, insights from analytical research, and a direct response to identified gaps in Philippine IT education and career choice research within the specific context of software testing careers. Unlike conventional models that emphasize primarily technical or educational factors, the CEC-IRTC framework incorporates distinctly Filipino collectivist values, unique local academic realities, and the effects of the current economic climate on career decision-making.

The framework's strength lies in its culturally grounded approach, which identifies actionable intervention points while emphasizing stakeholder participation to ensure applicability in both policy development and curriculum design. By integrating scholarly findings with real-world observations, it provides a comprehensive perspective on the factors influencing career decisions among Filipino IT students. This holistic and contextually sensitive approach positions the CEC-IRTC framework as a potentially significant contribution to the field, offering both theoretical insights and practical applications for addressing career choice challenges in Philippine IT education.

As illustrated in Fig. 1, the CEC-IRTC framework is structured around three interconnected pillars, Cultural Influences, Economic Factors, and Curricular Elements, that collectively shape Filipino IT students' career decisions, particularly their reluctance toward software testing careers. Each pillar comprises specific elements that contribute to the decision-making process. The dynamic relationships between these pillars, represented by broken lines with bidirectional arrows, demonstrate the framework's core novelty: Recognizing the co-existence and mutual reinforcement of these factors.
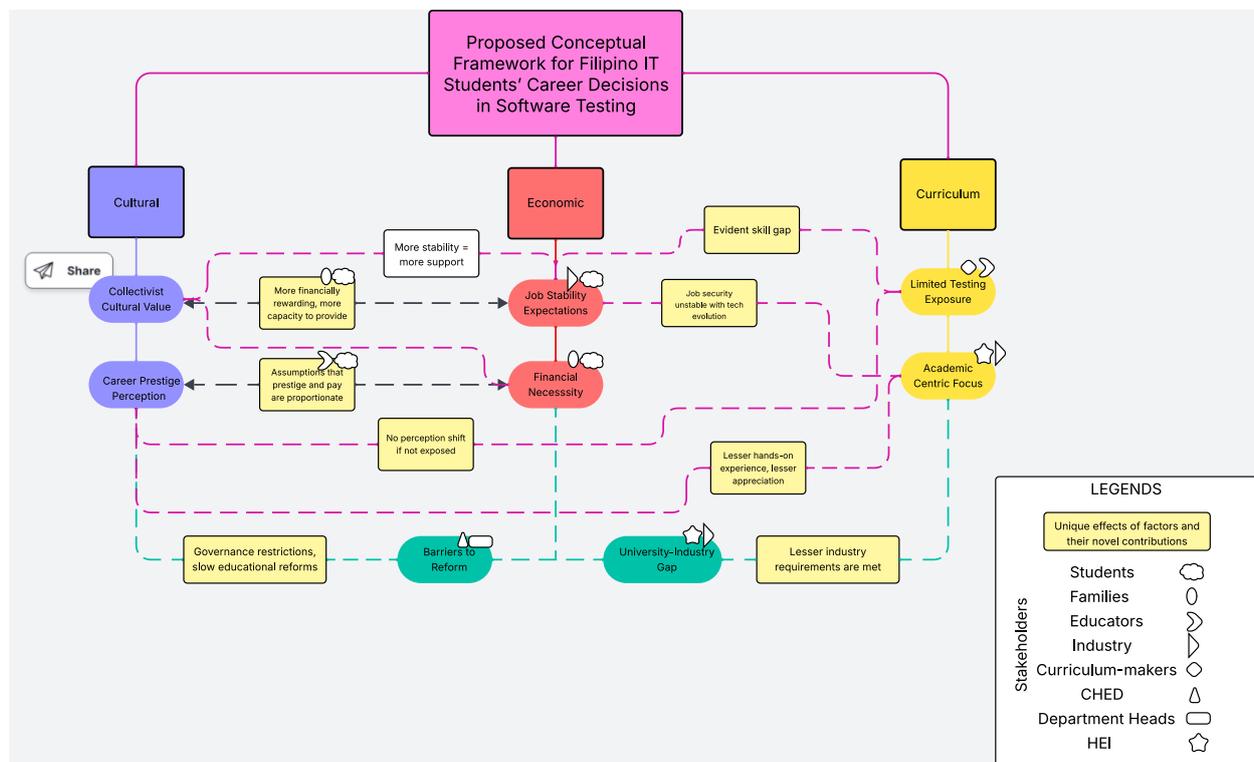
Note: Feedback loops and pathways that illustrate the relationships between components are represented by dashed lines, indicating the unique effects of co-existing factors within the pillars. This enhances the framework's novelty by showing how the three major foundations are interconnected and considered in the decision-making process of IT students in the Philippines

Fig. 1: Proposed conceptual framework for Filipino IT students' career decisions in software testing

The Cultural Influences pillar encompasses family expectations, peer perceptions, societal status associations, and collectivist values that are deeply embedded in Filipino culture. Family expectations reflect the strong influence of parental aspirations and familial obligations on career choices, where students often prioritize careers that bring honor and financial security to their families. Peer perceptions capture the social dynamics among students, where career choices are influenced by what is considered prestigious or desirable within their immediate social circles. Societal status associations refer to the broader cultural hierarchy of IT careers, where software development is often perceived as more prestigious than testing roles. Collectivist values underscore the emphasis on group harmony and social approval over individual preferences, leading students to gravitate toward careers that align with communal expectations rather than personal interests.

The Economic Factors pillar includes perceived earning potential, job market awareness, employment stability concerns, and resource accessibility. Perceived earning potential reflects

students' beliefs about salary prospects in different IT careers, with testing often misconceived as offering lower compensation than development roles. Job market awareness encompasses students' understanding of current industry demands and opportunities, which may be limited by inadequate exposure to diverse career paths. Employment stability concerns address students' anxieties about job security and long-term career viability in the volatile technology sector. Resource accessibility refers to the availability of career guidance, mentorship programs, and informational resources that enable informed decision-making about testing careers.

The Curricular Elements pillar comprises curriculum content and design, exposure to testing methodologies, hands-on learning opportunities, and industry-academia collaboration. Curriculum content and design examine how testing is positioned within the academic program, including whether it receives adequate emphasis compared to development-focused subjects. Exposure to testing methodologies assesses the depth and breadth of testing concepts introduced to students, from fundamental quality assurance principles to advanced testing frameworks. Hands-on learning opportunities refer to practical experiences such as laboratory exercises, projects, and internships that allow students to engage directly with testing practices. Industry-academia collaboration captures the extent to which academic institutions partner with industry professionals to provide real-world perspectives and experiences in software testing.

The framework's novelty lies in hypothesizing and explicating the dynamic, bidirectional relationships between these three pillars. The Cultural-Economic interaction demonstrates how cultural values shape economic perceptions and vice versa. For instance, family expectations rooted in a collectivist culture may amplify the importance of perceived earning potential, while economic realities can reinforce or challenge traditional status hierarchies associated with different IT careers. The Cultural-Curricular relationship reveals how cultural factors influence curricular priorities and pedagogical approaches. Societal status associations may lead to greater emphasis on development courses, while, at the same time, enhanced curricular exposure to testing can gradually shift cultural perceptions and reduce status-based stigma. The Economic-Curricular connection shows how economic factors drive curriculum design decisions, as institutions may prioritize teaching skills aligned with high-demand, high-paying jobs, while comprehensive curricular preparation in testing can improve students' awareness of its economic viability and career prospects.

These interconnections create feedback loops that either reinforce reluctance toward testing careers or, when strategically addressed, can transform perceptions and increase interest. For example, when cultural status associations devalue testing, this perception may lead to reduced curricular emphasis, which in turn limits students' economic awareness of testing opportunities, thereby reinforcing the initial cultural bias. Conversely, interventions that strengthen any single pillar can create positive cascading effects across the framework. Enhanced industry-academia collaboration (a curricular element) can increase job market awareness (an economic factor), which may gradually influence peer perceptions and societal status associations (cultural influences). This triadic, mutually reinforcing structure distinguishes the CEC-IRTC framework from linear or isolated factor models and positions it as a comprehensive tool for understanding and addressing career choice challenges in the Philippine IT education context.

The CEC-IRTC framework systematically incorporates cultural, economic, and curricular elements to enable a more comprehensive understanding of career motivations and perceptions among Filipino IT students. By bridging the limitations of previous research, it generates actionable insights relevant to local realities while drawing from effective international practices adapted to the Philippine context. Furthermore, the framework offers concrete recommendations for curriculum reform and policy development, ensuring that research outcomes are both contextually grounded and globally informed. This dual perspective provides a strong foundation for meaningful educational and institutional change in Philippine IT education.

5. Discussion

This systematic review reveals that software testing career reluctance among Filipino IT students emerges from the dynamic interplay of cultural values, economic perceptions, and curricular structures rather than isolated factors. The proposed CEC-IRTC framework challenges linear career decision-making models by demonstrating how these three dimensions create self-reinforcing cycles that systematically disadvantage software testing despite persistent industry demand. Comparative analysis yields unexpected insights; while collectivist societies demonstrate stronger family influence than Western contexts, the mechanisms differ substantially. Pakistani and Chinese contexts reveal explicit parental expectations, whereas the Philippine context demonstrates subtle influence through utang na loob and pakikisama that create internalized obligations. Most surprising is that prestige perceptions operate differently across cultures.

Western students perceive testing as boring based on task characteristics, while Asian students view it as "second-class" work, reflecting hierarchical stratification. This distinction carries profound intervention implications: Western contexts require curriculum reforms emphasizing testing's intellectual challenges, while Asian contexts need cultural reframing elevating testing's social legitimacy.

The framework's theoretical contribution lies in explicating feedback loops that previous research treated as independent factors. When cultural status associations devalue testing, institutions allocate fewer curricular resources, which limits students' economic awareness of opportunities, thereby reinforcing initial biases. This cycle operates automatically through aggregate effects of individual decisions within constrained choice architectures. The economic dimension reveals counterintuitive patterns; students underestimate testing compensation despite available salary data, indicating that economic evaluation occurs through culturally mediated frameworks rather than objective processing. The curricular dimension exposes how minimal emphasis on testing simultaneously creates skill gaps and sends implicit signals about professional legitimacy, explaining why reforms addressing only content prove insufficient without corresponding changes to curricular status and visibility.

While previous studies by Fernando Capretz et al. (2021) and Souza et al. (2022) demonstrated limited generalizability due to small samples and overlooked broader socio-economic factors in developing countries, this framework provides actionable insights extending beyond software testing to broader STEM career development in collectivist societies. For Philippine policymakers, these findings offer opportunities to establish comprehensive, internationally competitive curricula emphasizing the value. Career counselors gain insights to broaden students' awareness of diverse opportunities, advancing the Philippines' position in the global technology market. However, as a non-empirical review, this investigation requires validation through surveys and focus group discussions to verify Filipino students' actual perceptions. Despite this limitation, the CEC-IRTC framework extends career development models by explicating mechanisms through which macro-level cultural contexts shape micro-level decisions through meso-level institutional structures, providing a comprehensive diagnostic tool for educators, policymakers, and industry partners. This dual grounding, locally contextualized yet globally informed, positions the framework as a model for addressing STEM workforce development challenges in developing countries, navigating tensions between inherited educational structures, indigenous cultural values, and global economic integration.

6. Practical implications

This study offers important practical implications for curriculum developers, policymakers, and educators. For curriculum developers, cultural sensitivity frameworks should be integrated when designing software testing courses, recognizing how family expectations and perceptions of social prestige shape students' career decisions. Software testing competencies should be embedded throughout existing IT curricula rather than treated as a standalone subject, thereby increasing visibility and perceived importance. Experiential learning initiatives can further position software testing as a prestigious and high-impact technical specialty central to digital transformation, while structured industry partnerships can clarify career progression pathways and financial stability within the field.

From a policy perspective, comprehensive software testing education should be systematically incorporated into national IT curriculum guidelines to ensure consistent exposure across higher education institutions. Strengthening industry–academia linkages can provide students with direct engagement opportunities with professionals and clearer insight into career prospects. Public awareness campaigns may also be developed to emphasize the strategic and societal value of software testing in enhancing national digital competitiveness. In addition, scholarship and incentive programs targeting software testing specialization could help counteract cultural biases favoring more traditional career paths.

For educators, culturally responsive teaching strategies can frame software testing as a profession aligned with family responsibility, stability, and long-term career sustainability. Incorporating real-world industry case studies can highlight the societal impact and professional prestige of testing roles. Mentorship programs connecting students with successful Filipino software testing professionals may serve as culturally resonant role models, while collaborative learning environments that reflect collectivist values (e.g., pakikisama) can strengthen positive perceptions of software testing careers.

Overall, this research provides a theoretical foundation for meaningful reform. Its long-term impact, however, depends on educational leaders' willingness to implement culturally intelligent and empirically grounded strategies that align individual aspirations with national development objectives.

7. Conclusion

This research introduces the Cultural-Economic-Curriculum Influences on Reluctance Testing Careers (CEC-IRTC) Model, providing the first comprehensive theoretical framework that explains how deeply embedded Filipino cultural values create systematic barriers to software testing career adoption. The study reveals that cultural values such as utang na loob (debt of gratitude) and pakikisama (spirit of harmony within social groups) fundamentally shape career decision-making processes, steering students toward socially prestigious and financially stable professions while inadvertently marginalizing emerging technology roles like software testing. The findings demonstrate that the intersection of cultural obligation, family expectations, and social recognition creates a powerful force that prioritizes traditional career paths over specialized technical roles that lack social visibility. This paper presents an original synthesis that bridges international career development

literature with Philippine-specific cultural, economic, and educational realities. By critically analyzing culturally rooted values such as pakikisama, hiya, and utang na loob as potential barriers to technology career entry, the research introduces a novel perspective on how traditional values intersect with modern professional pathways. The study uniquely examines CHED-mandated curricula against global software testing competencies, creating an integration framework previously unexplored in existing research.

The CEC-IRTC Model offers a culturally responsive lens for understanding career choice patterns in collectivist societies, providing new theoretical direction for education and policy reform that honors cultural values while expanding professional opportunities. Additionally, the educational infrastructure reinforces these cultural biases through curricula that emphasize software development and coding while providing minimal exposure to software testing competencies, despite the field's critical importance in the global technology ecosystem.

For future work, a comprehensive validation study is planned to empirically test and refine the CEC-IRTC framework through mixed-methods research approaches. A survey involving 300 Filipino IT students is planned to validate the CEC-IRTC model, examining the relationships between cultural influences, economic considerations, and curricular factors in career decision-making processes. The survey will employ stratified random sampling across multiple educational institutions in different regions of the Philippines to ensure geographic and demographic representativeness.

Quantitative validation will utilize a structured questionnaire with Likert-scale items measuring each of the three foundational pillars. Cultural factors will be assessed through items examining family expectations, societal perceptions of testing careers, and cultural attitudes toward technological roles. Economic considerations will be evaluated through questions about salary expectations, job security concerns, and financial barriers to career entry. Curricular influences will be measured by examining students' exposure to software testing education, hands-on experience opportunities, and perceived adequacy of current IT programs in preparing them for testing careers.

List of abbreviations

AI	Artificial intelligence
BPO	Business process outsourcing
CEC-IRTC	Cultural–economic–curriculum influences on reluctance testing careers
CHED	Commission on higher education
CI/CD	Continuous integration and continuous delivery
CS	Computer science
IoT	Internet of things
IT	Information technology
IT-BPO	Information technology–business process outsourcing
ML	Machine learning
QA	Quality assurance
SDG4	Sustainable development goal 4
SE	Software engineering
SQA	Software quality assurance
STEM	Science, technology, engineering, and mathematics

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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