

# Cultivating Psychological Resources for Academic Success: A Three-Year Mixed-Methods Analysis of the Grow a Gritty HERO's Mindset Intervention

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**Abstract**—This study presents a comprehensive evaluation of the Grow a Gritty HERO's Mindset course for engineering students in Stellenbosch University's Extended Curriculum Program (ECP) across three cohorts from 2021 to 2024. We employ a mixed-methods approach integrating three complementary evaluation strategies: (1) pre-post quantitative assessment of well-being and psychological resources, (2) structured benefit analysis of perceived impacts, and (3) thematic analysis of student testimonials. Results show significant improvements across multiple dimensions, with particularly consistent positive effects on growth mindset, personal growth, self-awareness, and wellness habits. The convergence of findings across methodologies strengthens evidence for the intervention's effectiveness, while revealing a pattern of enhanced impact over time. The 2024 cohort demonstrated the most comprehensive improvements across all evaluation approaches. Our integrated analysis identifies four key impact domains where evidence triangulates across methodologies: mindset transformation, enhanced self-awareness and personal growth, improved resilience and coping, and development of positive psychological resources. These findings suggest the value of comprehensive psychological resource interventions for supporting student success in extended curriculum programs and highlight the benefits of multi-method evaluation approaches for understanding complex educational interventions.

**Index Terms**—psychological resources, academic success, mixed-methods evaluation, extended curriculum program, growth mindset, student well-being, higher education

## I. INTRODUCTION

The transition to university represents a critical developmental period for students, particularly those in extended curriculum programs who may face additional academic and psychological challenges [1] [2] [3]. This transition involves not only adapting to more rigorous academic demands but also navigating new social environments, cultural contexts, and identity challenges. For students in extended curriculum programs, these challenges may be further amplified by perceptions of stigma, concerns about belonging, and the need to develop effective academic strategies for a longer educational journey [4].

Beyond academic preparation, psychological resources such as mindset, resilience, and well-being have emerged as crucial contributors to student success [5], [6], [7]. Research has demonstrated that students' perceptions of their abilities,

their approaches to challenges, and their psychological well-being can profoundly influence their academic engagement, persistence, and achievement. Interventions targeting these psychological resources have shown promise for enhancing academic outcomes and student flourishing, yet comprehensive evaluations of such programs remain relatively rare, particularly in the South African context where extended curriculum programs play an important role in educational access and success.

Mixed-methods approaches that integrate quantitative and qualitative evaluation methodologies can provide particularly robust and nuanced understanding of complex educational interventions [8] [9]. By triangulating evidence from different methodological perspectives, researchers can strengthen confidence in findings while capturing both measurable changes and lived experiences of participants [10]. Such approaches are especially valuable for understanding interventions targeting psychological resources, where the subjective experience of participants may be as important as objective measures of change.

This article presents a comprehensive evaluation of the Grow a Gritty HERO's Mindset course, an intervention designed to enhance psychological resources and well-being among engineering students in Stellenbosch University's Extended Curriculum Program. We integrate three complementary evaluation approaches: (1) pre-post quantitative assessment of well-being and psychological resources, (2) structured benefit analysis of perceived impacts, and (3) thematic analysis of student testimonials. By analyzing data across three cohorts (2021, 2023, and 2024), we explore both consistent impacts and potential evolutionary changes in the intervention's effectiveness over time.

### A. Contextualizing the Grow a Gritty HERO's Mindset Course within Existing Interventions

The Grow a Gritty HERO's Mindset course builds upon several established intervention approaches while offering unique integration specifically designed for extended curriculum students. Growth mindset interventions have shown considerable promise in higher education contexts. Yeager et al.'s large-scale growth mindset intervention [11] demonstrated that even brief interventions targeting implicit theories of intelligence could improve academic outcomes for first-generation and

underrepresented minority students, with effects persisting through degree completion. Our approach incorporates key elements of these brief interventions while embedding them within a more comprehensive framework.

Similarly, social-belonging interventions like those developed by Walton and Cohen [12] have shown lasting effects on academic achievement and well-being, particularly for students from marginalized groups. Their research demonstrated that even a one-hour intervention framing social adversity as common and temporary improved GPA, health, and well-being outcomes for African American students over three years. The "Feeling You Belong" component of our course builds on this approach while connecting belonging explicitly to other psychological resources.

More comprehensive approaches include Schreiner's thriving initiatives [13], which address intellectual, social, and psychological well-being simultaneously. These interventions have shown promising results for student retention and engagement. Similarly, Seligman et al.'s positive psychology curriculum [14] at the University of Pennsylvania demonstrated improvements in students' social skills, engagement with learning, and reduction in depressive symptoms. Our approach shares the multidimensional focus of these programs while specifically tailoring content to the unique needs of extended curriculum engineering students.

Another significant initiative addressing student well-being and transition is the FLOURISH Project at the University of Toronto. This strengths-based resilience (SBR) approach was designed to support students transitioning from secondary to post-secondary education [15]. Based on Corey Keyes' Model of Complete Mental Health, which posits that mental health encompasses both the absence of symptoms and the presence of well-being, FLOURISH represents a comprehensive approach to student transition. Like our intervention, it integrates character strengths assessment with resilience training, but provides a unique implementation across multiple educational settings including university, clinical populations, and high schools. The FLOURISH Project's longitudinal data collection and analysis of over 2,900 first-year students revealed important insights about declining rates of flourishing and increasing rates of languishing among university entrants, with significant implications for graduation rates and service utilization [15].

### *B. Unique Contribution of the Grow a Gritty HERO's Mindset Course*

What distinguishes the Grow a Gritty HERO's Mindset course is its intentional integration of multiple psychological resources within a coherent framework specifically designed for extended curriculum students. While previous interventions have typically focused on either single constructs (like growth mindset or belonging) or general well-being, our approach targets the specific psychological challenges faced by students in extended programs, including potentially longer academic journeys, adaptation to engineering culture, and navigation of identity concerns within a transitional context.

This research contributes to the literature on educational interventions in several important ways. First, it provides a

comprehensive evaluation of a psychological resources intervention specifically designed for extended curriculum students, a population that has received limited attention in intervention research. Second, it demonstrates the value of integrating multiple evaluation methodologies to triangulate evidence and capture complex impacts. Third, it offers longitudinal insights into the consistent effects and potential evolution of intervention impacts across multiple cohorts, providing a more nuanced understanding of how such interventions may be refined and improved over time.

## **II. THE GROW A GRITTY HERO'S MINDSET COURSE**

### *A. Theoretical Framework*

The Grow a Gritty HERO's Mindset course integrates several theoretical frameworks from positive psychology and educational psychology. The name references its focus on developing psychological capital elements—Hope, Efficacy, Resilience, and Optimism (the HERO components)—alongside grit and growth mindset. This integrated approach reflects contemporary understanding that these psychological resources often function synergistically rather than in isolation [16].

The intervention draws on psychological capital theory [16], which proposes that these four psychological resources can be developed and have measurable impact on performance and well-being. It incorporates growth mindset theory [6], which distinguishes between fixed mindsets (believing abilities are static) and growth mindsets (believing abilities can be developed through effort and learning). The course also builds on grit and perseverance research [5], which highlights the importance of passion and persistence for long-term goals.

Additionally, the intervention integrates well-being frameworks including Hettler's six-dimensional wellness model [17] (physical, emotional, social, intellectual, spiritual, and occupational wellness), the PERMA framework (Positive emotions, Engagement, Relationships, Meaning, and Accomplishment) developed by Seligman [18], and VanderWeele's flourishing conceptualizations [19], which broadens well-being to include character, virtue, and financial stability alongside more traditional dimensions.

Keyes' conceptualization of mental health as a complete state—encompassing both the absence of mental illness and the presence of flourishing—provides a further crucial theoretical foundation for our intervention [20]. His research demonstrates that students with higher levels of positive mental health show greater academic engagement and achievement, even when controlling for psychological distress [21]. In a study of more than 1,200 nationally representative adolescents between the ages of 12 and 18, Keyes found that approximately 38 percent of adolescents were flourishing, 56 percent were moderately mentally healthy, and 6 percent were languishing [21]. This dual-continua model underscores the importance of promoting flourishing rather than merely addressing problems—a philosophy that aligns with our intervention's approach to developing psychological resources proactively rather than remedially.

By drawing on these complementary frameworks, the course aims to support the development of psychological resources

and well-being in a holistic manner, recognizing the interconnections between different aspects of psychological functioning and their collective impact on student success.

### B. Course Structure and Content

The course is delivered over one academic semester through six modules addressing eight action themes, as outlined in Table 1. Each module includes a variety of activities designed to develop specific psychological resources while also fostering connections between different components of the intervention.

The first module, "Be Well & Feeling at Home," focuses on creating a foundation of belonging and wellness awareness. It addresses two critical needs of first-year students: feeling connected to their new educational environment and understanding the dimensions of wellness that contribute to overall well-being. Activities in this module help students recognize that their transition challenges are shared by others and develop a holistic view of well-being beyond academic success.

The second module, "Grow Your Grit," helps students develop perseverance and passion for long-term goals. The "Meet Me in Ten Years" exercise encourages students to envision their future selves, connecting present challenges to meaningful future outcomes. The "Wheel of Life Reflection" helps students assess balance across different life domains, recognizing areas that may need attention for sustained grit.

In the third module, "Cultivate a Growth Mindset," students learn to recognize and shift from fixed to growth mindset perspectives. The "Growth Mindset Continuum" activity helps students understand that mindset exists on a spectrum and can vary across different domains of life. By identifying their current mindset tendencies, students can develop strategies for embracing challenges and learning from setbacks.

The fourth module, "Believe in Yourself in the Big Moments," focuses on developing self-efficacy—the belief in one's ability to succeed in specific situations. The "Victory Log" provides a structured way for students to document and reflect on past successes, creating a repository of evidence for their capabilities that they can draw on when facing new challenges.

The fifth module, "Bounce Back Better," addresses resilience development. The "Finding Silver Linings" activity helps students practice cognitive reframing of negative events, while the "Resilience Plan" guides them in developing specific strategies for navigating future challenges using the 4 S's framework (Support, Strategies, Sagacity, and Solution-seeking).

The final module, "Have High Hope & Be Optimistic," integrates hope theory and learned optimism. Students learn to develop both pathways thinking (identifying routes to goals) and agency thinking (maintaining motivation to use those routes). Optimism exercises help students recognize and challenge pessimistic explanatory styles while developing more constructive interpretations of events.

Throughout the course, these modules build upon one another in a deliberate sequence, with earlier modules establishing foundational psychological resources that support the

development of more complex capabilities in later modules. The course is delivered through a blended approach combining online activities with in-person components, allowing for both independent reflection and collaborative learning.

## III. METHODOLOGY

### A. Participants

Participants were engineering students enrolled in Stellenbosch University's Extended Curriculum Program (ECP) who completed the Grow a Gritty HERO's Mindset course. The course is part of a compulsory first-year module called "University Practice 176." These ECP students were part of a program that extends the standard engineering curriculum by one year, providing additional academic support and development opportunities. Data were collected from three cohorts as shown in Table 2.

The 2022 cohort was excluded from analysis due to insufficient sample size resulting from administrative challenges that affected data collection that year. This exclusion, while creating a gap in the year-to-year progression, allowed us to maintain methodological rigor by focusing on cohorts with adequate sample sizes for statistical analysis.

The demographic composition of the cohorts was generally similar across years, with participants representing diverse backgrounds in terms of prior educational experiences, socioeconomic status, and cultural backgrounds, reflecting the broader composition of the Extended Curriculum Program at Stellenbosch University.

### B. Evaluation Approaches

Three complementary evaluation approaches were employed to provide a multi-faceted understanding of the intervention's impact.

1) **Pre-Post Quantitative Assessment:** A pretest-posttest design measured changes across multiple dimensions of well-being and psychological resources - see figure 1. Pre-intervention measures were collected through the SUBSIFY questionnaire (Stellenbosch University Baseline Survey for Incoming First-Years) during the February welcoming period. Post-intervention assessments were conducted via a Check-In Survey during May/June exams after course completion. The measurement frameworks included:

a) **EPOCH Wellbeing [22]:** This measure assesses five dimensions of adolescent well-being—Engagement (absorption in activities), Perseverance (persistence toward goals), Optimism (confidence about the future), Connectedness (satisfying relationships), and Happiness (positive emotional states)—each measured on a 1-5 scale.

b) **Harvard Flourishing Index [19]:** This framework measures six dimensions of flourishing—Happiness & Life Satisfaction, Physical & Mental Health, Meaning & Purpose, Character & Virtue, Relationships, and Financial Stability—on a 0-10 scale. Two composite indices are calculated: the Flourishing Index (average of first five dimensions) and the Secure Flourishing Index (average of all six dimensions).

TABLE I  
COURSE STRUCTURE AND KEY ACTIVITIES

Module	Action Themes	Key Activities
1. Be Well & Feeling at Home	Feeling You Belong, Enhance Wellness & Well-being	"Feeling You Belong" writing exercises, Six dimensions of wellness reflection, PERMA-V assessment
2. Grow Your Grit	Grow Your Grit	Grit Self-assessment, "Meet Me in Ten Years" future visioning, "Wheel of Life Reflection"
3. Cultivate a Growth Mindset	Cultivate a Growth Mindset	Mindset assessment, "Name that Mindset" identification, "Growth Mindset Continuum" reflection, 20 Guidelines to Developing a Growth Mindset Reflection
4. Believe in Yourself in the Big Moments	Believe in Yourself	Self-efficacy Scale, "Keep a Victory Log," Confidence-building exercises
5. Bounce Back Better	Increase Your Resilience	"Finding Silver Linings" reframing, "The Resilience Plan (4 S's)," Resilience assessment
6. Have High Hope & Be Optimistic	Hope, Be Optimistic	"Nurture Your Hope" worksheet, Optimism exercises, Hope assessment

TABLE II  
STUDY PARTICIPANTS BY COHORT

Cohort	Pre-Post Data	Testimonials and Benefit Analysis
2021	n=40	n=33
2023	n=41	n=34
2024	n=35	n=27

The course is simultaneously offered to ECP students from the Faculties of Science, Engineering and AgriSciences. This paper only focuses on the impact of the course on students from Engineering. Only students who completed both the pre- and post survey assessments were included. Too few students from 2022 completed both and the 2022 cohort was consequently excluded from the study.

c) **Psychological Resources:** Several established measures assessed specific psychological resources, including Growth Mindset [6], Grit and its subdimensions of Perseverance of Effort and Consistency of Interest [5], Hope and its components of Waypower and Willpower [23], Self-Efficacy [24], and Stress Mindset [25].

d) **Individual Wellness Habits:** Thirteen habits across Hettler's six wellness dimensions [17] were assessed, capturing specific behaviors and practices related to physical, emotional, social, intellectual, spiritual, and occupational wellness.

2) **Structured Benefit Analysis:** After completing the course and final assessment, students voluntarily indicated which benefits they personally experienced from a predetermined list of 14 potential outcomes. This approach provided a standardized way to assess perceived impacts across cohorts, complementing the pre-post measures with student-identified benefits. The benefit analysis captured both the breadth of perceived impacts (how many different benefits students reported) and their relative frequency (which benefits were most commonly identified).

3) **Thematic Analysis of Testimonials:** Students provided written testimonials describing how they benefited personally from the course. These narratives were analyzed using Braun and Clarke's six-phase thematic analysis approach [26]: familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the analysis. This qualitative process was conducted with analytical support from Claude, an AI assistant (detailed methodology in Appendix A), while maintaining the focus on capturing the lived experiences of students and their meaning-

making processes, providing insights that might not emerge from standardized measures.

### C. Integrated Analysis

Following the separate analyses, an integration process was conducted to identify areas of convergence, complementarity, and divergence across the three evaluation approaches. This integration followed mixed-methods integration principles described by [10], focusing particularly on triangulation patterns and meta-themes that emerged across evaluation methodologies.

The integration process involved several steps: (1) identifying findings from each evaluation approach that addressed similar constructs or dimensions, (2) comparing patterns of results across methodologies to identify convergence or divergence, (3) developing integrated meta-themes that captured findings across approaches, and (4) examining how the integrated findings contributed to a more comprehensive understanding of the intervention's impact.

This integrated analysis allowed us to strengthen confidence in findings through triangulation, identify complementary insights that emerged from different methodologies, and develop a more nuanced understanding of how the intervention impacted students across different dimensions and over time.

## IV. RESULTS

### A. Pre-Post Quantitative Assessment

1) **EPOCH Wellbeing:** The EPOCH assessment revealed varying patterns of improvement across cohorts, with the 2024



Fig. 1. Pre-Post Quantitative Assessment

cohort showing the most comprehensive positive changes. Table 3 summarizes the significant changes in EPOCH dimensions across the three cohorts.

The 2021 cohort showed significant improvements in Engagement, Optimism, and Happiness, along with overall EPOCH score. The 2023 cohort demonstrated significant improvement only in Connectedness, although the overall EPOCH score showed a positive trend approaching significance ( $p=0.083$ ). The 2024 cohort exhibited the most comprehensive improvements, with significant positive changes in four dimensions (Perseverance, Optimism, Connectedness, and Happiness) and overall EPOCH score.

Across cohorts, Optimism and Happiness showed the most consistent improvements, suggesting the intervention may be particularly effective at enhancing positive future outlook and emotional well-being. The development of Connectedness appears to have strengthened in later cohorts, possibly reflecting refinements in the intervention's approach to fostering social belonging. The emergence of significant improvement in Perseverance only in the 2024 cohort suggests potential enhancement of the intervention's effectiveness at developing persistence toward goals.

2) **Harvard Flourishing Index:** The flourishing assessment revealed an expanding pattern of positive impacts across cohorts, with the 2024 cohort again showing the most comprehensive improvements. Table 4 summarizes the significant changes in flourishing dimensions across the three cohorts.

The 2021 cohort showed significant improvement only in the Relationships dimension, along with subdimensions of Overall Life Satisfaction ( $p=0.014$ ) and Relationship Satisfaction ( $p=0.014$ ). The 2023 cohort demonstrated significant

improvements in the Character & Virtue dimension and the Secure Flourishing Index, as well as subdimensions of General Happiness ( $p=0.011$ ), Promote Good Always ( $p=0.020$ ), and reduced Worry about Safety/Food/Housing ( $p=0.013$ ).

The 2024 cohort exhibited the most comprehensive flourishing improvements, with significant positive changes in the Happiness & Life Satisfaction dimension, Physical & Mental Health dimension, and Relationships dimension. Both the Flourishing Index and Secure Flourishing Index showed significant improvements for this cohort, along with multiple subdimensions.

The pattern across cohorts suggests an expanding impact on flourishing over time, with each cohort showing improvements in different but complementary aspects of flourishing. The Relationships dimension showed the most consistent improvement across cohorts, aligning with the EPOCH Connectedness findings and highlighting the intervention's effectiveness at enhancing social well-being. The significant improvements in both the Flourishing Index and Secure Flourishing Index for the 2024 cohort suggest a more holistic impact on overall well-being in the most recent implementation.

3) **Psychological Resources and Wellness:** The assessment of specific psychological resources revealed both consistent patterns and variable impacts across cohorts. Table 5 summarizes the significant changes in psychological resources across the three cohorts.

Growth mindset showed the most consistent and substantial improvements across all three cohorts, with highly significant positive changes in each year. This finding suggests the intervention is particularly effective at developing students' beliefs about the malleability of abilities through effort and

TABLE III  
SIGNIFICANT CHANGES IN EPOCH DIMENSIONS BY COHORT

EPOCH Dimension	2021 Cohort	2023 Cohort	2024 Cohort	Cross-Cohort Pattern
Engagement	✓ (3.24→3.49, p=0.016)	-	-	Stronger impact in earlier cohort
Perseverance	-	-	✓ (3.85→4.14, p=0.045)	Only significant in 2024
Optimism	✓ (3.93→4.12, p=0.013)	-	✓ (4.10→4.43, p=0.019)	Consistent impact in 2021 & 2024
Connectedness	-	✓ (3.80→4.14, p=0.031)	✓ (3.74→4.26, p=0.006)	Increasing impact in later cohorts
Happiness	✓ (3.48→3.76, p=0.008)	-	✓ (3.33→3.79, p=0.043)	Consistent impact in 2021 & 2024
Overall EPOCH	✓ (3.78→3.94, p=0.003)	-	✓ (3.65→3.98, p=0.032)	Consistent impact in 2021 & 2024

"✓" indicates statistically significant improvement (p<0.05); "-" indicates non-significant change.

TABLE IV  
SIGNIFICANT IMPROVEMENTS IN FLOURISHING DIMENSIONS BY COHORT

Flourishing Dimension	2021 Cohort	2023 Cohort	2024 Cohort
Happiness & Life Satisfaction	-	-	✓ (6.06→7.53, p=0.005)
Physical & Mental Health	-	-	✓ (6.06→7.16, p=0.042)
Meaning & Purpose	-	-	-
Character & Virtue	-	✓ (7.49→8.16, p=0.015)	-
Relationships	✓ (6.99→7.60, p=0.048)	-	✓ (6.66→8.13, p=0.005)
Financial Stability	-	-	-
Flourishing Index	-	-	✓ (6.83→7.94, p=0.012)
Secure Flourishing Index	-	✓ (6.60→7.08, p=0.034)	✓ (6.65→7.59, p=0.032)

"✓" indicates statistically significant improvement (p<0.05); "-" indicates non-significant change

TABLE V  
SIGNIFICANT CHANGES IN PSYCHOLOGICAL RESOURCES BY COHORT

Psychological Resource	2021 Cohort	2023 Cohort	2024 Cohort	Cross-Cohort Pattern
Growth Mindset	✓ (4.07→4.63, p<0.0001)	✓ (4.04→4.55, p=0.005)	✓ (3.91→4.51, p<0.001)	Consistent strong impact across all cohorts
Overall Grit	-	~ (3.55→3.77, p=0.057)	-	Limited impact; approaching significance only in 2023
Grit: Consistency of Interest	-	✓ (3.21→3.54, p=0.029)	-	Impact only in 2023 cohort
Grit: Perseverance of Effort	-	-	-	No significant impact across cohorts
Stress Mindset	✓ (1.73→2.19, p=0.0003)	-	-	Impact only in 2021 cohort
Overall Hope	-	-	-	No significant impact across cohorts
Hope: Waypower	-	-	-	No significant impact across cohorts
Hope: Willpower	-	-	✓* (6.63→6.05, p=0.035)	Significant decrease in 2024 cohort
Self-Efficacy	-	-	-	No significant impact across cohorts
Overall Wellness Habits	✓ (47.12→50.10, p=0.001)	✓ (47.17→50.56, p=0.019)	✓ (46.46→51.14, p=0.024)	Consistent impact across all cohorts

"✓" indicates statistically significant improvement (p<0.05); "~" indicates change approaching significance (p<0.1); "-" indicates non-significant change; "✓\*" indicates statistically significant decrease.

learning, a psychological resource that has been linked to academic resilience and achievement in prior research [11].

Overall wellness habits also showed significant improvements across all three cohorts, indicating the intervention's consistent positive impact on wellness behaviors and practices. Specific wellness habits showing significant improvements varied somewhat by cohort, though sense of humor demonstrated significant enhancement across all three cohorts.

Other psychological resources showed more variable patterns. The 2021 cohort uniquely demonstrated significant improvement in stress mindset, suggesting enhanced belief in the potentially positive role of stress. The 2023 cohort showed the most improvement in grit-related measures, with

significant enhancement of consistency of interest. The 2024 cohort unexpectedly showed a significant decrease in the willpower component of hope, a finding that warrants further investigation.

The variable impacts on different psychological resources across cohorts may reflect evolving emphases in the intervention implementation, cohort-specific characteristics, or interacting factors in the broader educational environment. However, the consistent strong improvements in growth mindset and overall wellness habits suggest these may be core strengths of the intervention regardless of implementation variations.

## B. Results: Benefit Analysis

The structured benefit analysis revealed both consistently high-impact benefits and evolving patterns of perceived benefits across cohorts. Table 6 presents the percentage of students reporting each benefit by cohort.

Three benefits maintained consistently high reporting rates (>70% in most cohorts) across all three years: personal growth, increased self-awareness, and an attitude of gratitude. These consistently high-impact benefits suggest core strengths of the intervention that transcend particular implementations or cohort characteristics.

Several benefits showed a clear positive trend across cohorts, with the 2024 cohort reporting substantially higher rates than earlier cohorts. Most notably, "an improved mindset" increased dramatically from 36.4% in 2021 to 70.4% in 2024, and "learning new coping skills" rose from 48.5% in 2021 to 77.8% in 2024. Other benefits showing consistent increases included "a growing sense of purpose," "motivation to persevere," and "addressing challenges in my life."

Some benefits showed more variable patterns across cohorts. "Being equipped with practical life tools" and "acknowledging my strengths" dropped substantially in the 2023 cohort before recovering in 2024, suggesting possible implementation differences in that year. "The helpful nature of i-FlourishWell4Life" (the online platform) showed the most variability, potentially reflecting changes in the platform itself or its role in the overall intervention.

The average percentage of students reporting benefits across all categories showed a positive trend, rising from 54.0% in 2021 and 50.2% in 2023 to 65.9% in 2024. This pattern suggests the intervention's perceived effectiveness has strengthened over time, with the 2024 cohort experiencing the most comprehensive benefits.

## C. Results: Thematic Analysis of Testimonials

1) **Persistent Core Themes Across Cohorts:** The thematic analysis of student testimonials revealed four themes that remained consistently prominent across all three cohorts, though with distinctive evolutionary patterns in how these themes manifested. Table 7 summarizes the evolution of these core themes across cohorts.

The **Mindset Transformation** theme showed significant evolution in complexity and integration over time. In the 2021 cohort, students typically described basic shifts from fixed to growth mindset, often using terminology directly from the course. For example, one student wrote:

I switched from a judger and negative mindset to a positive learner mindset

*Student 14, 2021 cohort*

By 2023, testimonials more frequently described specific applications of mindset changes to real-world challenges, particularly academic ones:

Learning about having a growth mindset and a fixed mindset made me recognize how fixed minded I was and how I would need to develop a growth mindset and step out

of my comfort zone to learn and experience more.

*Student 7, 2023 cohort*

The 2024 cohort demonstrated even more sophisticated integration of mindset concepts with other psychological resources:

I have learned to be out of my comfort zone and try new things, just because you are not good at it, it does not mean you cannot be, 'The Power of Yet.'

*Student 18, 2024 cohort*

**Enhanced Self-Awareness** similarly showed progressive deepening across cohorts. Early testimonials often described general recognition of personal characteristics, while later cohorts articulated more nuanced self-understanding and its connections to other domains. A 2021 student wrote:

Through the course, the journaling about my feelings, the future and present has helped me. I have gained a lot. As a person I think if anything I am more conscious and aware now

*Student 19, 2021 cohort*

By 2024, students were describing more integrated self-awareness:

I gained self-awareness, I was able to reflect on both my strengths and weaknesses and this helped better understand who I am as well as where I need to improve.

*Student 14, 2024 cohort*

The **Transition Support and Belonging** theme evolved from primarily individual experiences toward greater emphasis on social connection. In 2021, students typically acknowledged the course's help in adjusting to university life:

This module helped me grow as an individual in all domains of life. I'm glad this module was integrated in our course as it helped me with my transitioning from high school to university.

*Student 16, 2021 cohort*

By 2023, testimonials more explicitly emphasized social connections:

In university you can't be all alone like in high school... I came in with that thinking to university, but thankfully this module made me change that.

*Student 2, 2023 cohort*

The 2024 cohort integrated belonging with other psychological resources:

The Be Well and Feeling at Home module and the activities and material helped me to settle well into my university life and to be able to accept and believe in change

*Student 3, 2024 cohort*

**Resilience Development** showed increasing sophistication in students' understanding and application. Early testimonials focused on basic concepts of bouncing back:

TABLE VI  
PERCENTAGE OF STUDENTS REPORTING BENEFITS BY COHORT

Reported Benefit	2021 Cohort	2023 Cohort	2024 Cohort	Trend
Personal growth	75.8%	76.5%	88.9%	Increasing
An increase in self-awareness	72.7%	76.5%	85.2%	Increasing
An attitude of gratitude	72.7%	61.8%	77.8%	Variable
Positive and helpful thinking patterns	72.7%	64.7%	70.4%	Relatively stable
The cultivation of a positive outlook	63.6%	64.7%	59.3%	Relatively stable
A growing sense of purpose	51.5%	52.9%	66.7%	Increasing
Being equipped with practical life tools	51.5%	29.4%	51.9%	Variable
Motivation to persevere	51.5%	50.0%	66.7%	Increasing
Learning new coping skills	48.5%	58.8%	77.8%	Strongly increasing
Support with my studies	48.5%	58.8%	55.6%	Relatively stable
Addressing challenges in my life	48.5%	52.9%	63.0%	Increasing
Acknowledging my strengths	42.4%	20.6%	48.1%	Variable
An improved mindset	36.4%	44.1%	70.4%	Strongly increasing
Helpful nature of i-FlourishWell4Life	24.2%	11.8%	40.7%	Variable
<b>Average across all benefits</b>	<b>54.0%</b>	<b>50.2%</b>	<b>65.9%</b>	<b>Increasing</b>

TABLE VII  
EVOLUTION OF CORE THEMES ACROSS COHORTS

Theme	2021 Cohort	2023 Cohort	2024 Cohort	Evolution Pattern
<b>Mindset Transformation</b>	Focus on shifting from fixed to growth mindset	Emphasis on applying mindset changes to specific challenges	More sophisticated articulation of mindset transformation	Increasing complexity and integration
<b>Enhanced Self-Awareness</b>	Basic self-discovery narratives	More detailed self-understanding	Deep integration of self-knowledge with other domains	Progressive deepening
<b>Transition Support and Belonging Resilience Development</b>	Basic acknowledgment of transition support Focus on bouncing back from setbacks	Greater emphasis on social connection More specific application to academic challenges	Integration of belonging with other psychological resources More nuanced understanding incorporating "falling forward"	From individual to social focus Increasing sophistication

I am slowly growing my grit and cultivating a growth mindset. I am able to bounce back better from setbacks and I am starting to gain confidence.

*Student 27, 2021 cohort*

The 2023 cohort more frequently applied resilience to specific academic challenges:

The course helped me shift my perspective on failure and setbacks, viewing them as opportunities for growth rather than roadblocks.

*Student 1, 2023 cohort*

By 2024, students articulated more nuanced understanding:

I have learned that it is okay to have a backup plan because this means you are falling forward and not backwards.

*Student 18, 2024 cohort*

2) **Evolutionary Patterns:** Beyond the core themes, several notable evolutions were observed in how students engaged with and articulated the impact of the course over the three cohorts:

*a) From Individual Focus to Social Integration:*

Early testimonials (2021) emphasized individual psychological changes, while later cohorts increasingly highlighted social dimensions. The 2024 cohort frequently integrated personal development with social contexts:

Although initially, I was indifferent to the 'Grow a Gritty HERO's Mindset' course, I quickly realised how beneficial this course

was... Before the course, I was relatively closed off and unable to open up to others truly, however, after the course, I am a lot more comfortable around others and more willing to create meaningful relationships.

*Student 13, 2024 cohort*

*b) From Theoretical Appreciation to Practical Application:* A progression from appreciating concepts to actively applying them was observed across cohorts. The 2021 testimonials often described learning valuable information, while 2023 and 2024 testimonials increasingly described specific applications to academic challenges, personal relationships, and future planning. One 2024 student wrote:

I will be using some of the exercises in my life like journaling and writing my goals down more specific every now and then to keep me motivated"

*Student 16, 2024 cohort*

*c) From Separate Skills to Integrated Capabilities:* Students' understanding evolved from discrete skills to integrated capabilities. The 2021 cohort tended to discuss individual course components separately, the 2023 cohort began connecting different elements, and the 2024 cohort demonstrated sophisticated integration of multiple course components into coherent approaches to life challenges.

*d) From Present-Focused to Future-Oriented:* A shift occurred in the temporal orientation of testimonials, with early cohorts focusing primarily on immediate benefits and current challenges, while later cohorts increasingly articulated how

course concepts would be applied to future challenges and long-term goals.

*e) From Receptive Learning to Transformative Journey:* The narrative structure of testimonials evolved significantly across cohorts. In 2021, students typically described receiving valuable information and skills, positioning themselves as relatively passive recipients of course content. By 2023, students more frequently recognized personal change processes and their active role in transformation. The 2024 cohort often articulated profound transformative journeys with clear before-and-after narratives. As one 2024 student wrote:

The 'Grow a Gritty HERO's Mindset' course has completely transformed my life. It's not just another self-help program; it's a personal journey of triumph... Before the course, I often found myself grappling with setbacks and challenges, feeling overwhelmed and defeated by life's hurdles. However, the course equipped me with practical strategies... I now confront challenges with a sense of confidence and determination, knowing I possess the tools and mindset to conquer any obstacle.

*Student 20, 2024 cohort*

This evolution across cohorts suggests a deepening engagement with the intervention over time, potentially reflecting refinements in course delivery, increasing institutional knowledge about effective facilitation, or changing student expectations based on peer experiences with the course.

#### ***D. Integrated Analysis: Triangulation Across Evaluation Approaches***

The integration of findings from pre-post assessment, benefit analysis, and thematic analysis revealed areas of strong convergence across evaluation approaches, providing more robust evidence for certain impacts while also highlighting complementary insights from different methodologies. Table 8 summarizes the triangulation of evidence across evaluation approaches for key impact domains.

**1) Strong Convergence Domains: Mindset Transformation** emerged as an area of particularly strong convergence across all three evaluation approaches. The pre-post assessment demonstrated significant improvements in growth mindset across all three cohorts, with substantial effect sizes. The benefit analysis showed dramatic increases in reporting of "an improved mindset," especially in the 2024 cohort. The thematic analysis identified mindset transformation as a persistent core theme, with increasingly sophisticated articulation over time. This triangulation strengthens confidence that mindset transformation represents a genuine and central impact of the intervention.

The convergence on mindset transformation is particularly notable because the three methodologies assess different aspects of this phenomenon—the pre-post assessment measures change in beliefs about malleability of abilities, the benefit analysis captures conscious recognition of mindset improvement, and the thematic analysis reveals how students

understand and apply this transformation in their lives. The alignment across these different perspectives suggests a robust and multifaceted impact on students' mindsets.

**Enhanced Self-Awareness and Personal Growth** also showed strong convergence across evaluation approaches. The pre-post assessment revealed improvements in various measures related to self-understanding, including EPOCH engagement (2021), flourishing subdimensions, and multiple wellness habits. The benefit analysis consistently showed high rates of reporting for "personal growth" and "an increase in self-awareness" across all cohorts. The thematic analysis identified enhanced self-awareness as a persistent theme with progressive deepening over time. This triangulation suggests that enhanced self-awareness and personal growth represent core impacts of the intervention that remain consistent despite variations in implementation or cohort characteristics.

**Development of Positive Psychological Resources** demonstrated strong convergence as well. The pre-post assessment showed significant improvements in EPOCH optimism (2021, 2024), happiness (2021, 2024), and flourishing dimensions related to happiness and life satisfaction. The benefit analysis revealed consistently high reporting of "attitude of gratitude" and "positive outlook." The thematic analysis identified the development of optimism and positive outlook as important themes, particularly in the 2023 and 2024 cohorts. This convergence suggests the intervention effectively promotes positive emotions and perspectives, providing psychological resources that may support resilience and well-being.

**2) Moderate Convergence Domains: Improved Resilience and Coping** showed moderate to strong convergence. The pre-post assessment demonstrated improvements in stress mindset (2021), aspects of grit (2023), and wellness habits related to coping. The benefit analysis revealed increasing reports of "learning new coping skills" across cohorts. The thematic analysis identified resilience development as a consistent theme with increasingly sophisticated descriptions over time. While the specific measures showing improvement varied somewhat across cohorts, the general pattern suggests genuine enhancement of resilience and coping capabilities.

**Enhanced Social Connection** showed moderate convergence. The pre-post assessment revealed improvements in EPOCH connectedness (2023, 2024) and the relationships dimension of flourishing across all cohorts. The benefit analysis showed variable reporting of social connection benefits. The thematic analysis identified an evolution from individual focus to social integration across cohorts. This pattern suggests that while social connection may not be the most prominently perceived benefit, the intervention does appear to enhance social well-being, particularly in later cohorts.

**Wellness and Balanced Lifestyle** also showed moderate convergence. The pre-post assessment demonstrated significant improvements in overall wellness habits across all cohorts. The benefit analysis showed moderate reporting of wellness-related benefits. The thematic analysis revealed increased emphasis on wellness and balanced lifestyle in later cohorts. This pattern suggests that wellness improvements, while not always the most salient to students in their subjective experience, do represent a consistent objective impact of the

TABLE VIII  
EVIDENCE TRIANGULATION ACROSS EVALUATION APPROACHES

Impact Domain	Pre-Post Assessment Evidence	Benefit Analysis Evidence	Thematic Analysis Evidence	Triangulation Strength
<b>Mindset Transformation</b>	Growth mindset showed significant improvement across all cohorts (p<0.001-0.005)	"Improved mindset" reporting increased from 36.4% to 70.4%	Persistent core theme with increasingly sophisticated articulation	Strong convergence
<b>Enhanced Self-Awareness and Personal Growth</b>	Improvements in EPOCH engagement, flourishing subdimensions, wellness habits	Consistently high reporting of "personal growth" (75.8-88.9%) and "self-awareness" (72.7-85.2%)	Persistent theme with progressive deepening	Strong convergence
<b>Improved Resilience and Coping</b>	Improvements in stress mindset (2021), aspects of grit (2023), wellness habits	"Learning new coping skills" increased from 48.5% to 77.8%	Consistent theme with increasing sophistication	Moderate to strong convergence
<b>Development of Positive Psychological Resources</b>	Improvements in EPOCH optimism and happiness, flourishing dimensions	High reporting of "attitude of gratitude" (61.8-77.8%) and "positive outlook" (59.3-64.7%)	Important theme in 2023 and 2024 cohorts	Strong convergence
<b>Enhanced Social Connection</b>	Improvements in EPOCH connectedness, relationships dimension	Variable reporting	Evolution from individual focus to social integration	Moderate convergence
<b>Wellness and Balanced Lifestyle</b>	Significant improvements in overall wellness habits	Moderate reporting	Increased emphasis in later cohorts	Moderate convergence

intervention.

#### E. Evolution Across Cohorts

A notable pattern across all evaluation approaches was the evidence for enhanced impact in the 2024 cohort compared to earlier cohorts:

- In the pre-post assessment, the 2024 cohort showed the most comprehensive improvements across measurement frameworks, with significant positive changes in four EPOCH dimensions, three flourishing dimensions, both flourishing indices, and multiple subdimensions and wellness habits.
- In the benefit analysis, the 2024 cohort reported higher rates of benefits across nearly all categories, with an average of 65.9% reporting benefits compared to 54.0% in 2021 and 50.2% in 2023.
- In the thematic analysis, the 2024 cohort demonstrated more sophisticated integration of concepts, more transformative narratives, and greater application to future contexts.

This convergent evidence strengthens the case for genuine enhancement of the intervention's impact over time, potentially reflecting refinement of program content, improved delivery methods, or increased institutional knowledge about effective implementation strategies.

## V. DISCUSSION

The integration of three complementary evaluation approaches provides a rich understanding of the Grow a Gritty HERO's Mindset course's impact on engineering students in an Extended Curriculum Program. The findings reveal both consistent core impacts across cohorts and an evolution in the intervention's effectiveness over time. This section explores the implications of these findings for theory, practice, and future research.

#### A. Strengths of Multi-Method Evaluation

The use of multiple evaluation methodologies significantly enhanced our understanding of the intervention's impact in ways that would not have been possible through any single approach. This multi-method design provided several important benefits for the evaluation.

The convergent validation across methodologies strengthens confidence in the intervention's core effects, particularly for mindset transformation, self-awareness, and personal growth. When multiple assessment strategies—each with different strengths, limitations, and potential biases—point to similar conclusions, we can have greater confidence in the robustness of these findings. This triangulation is especially valuable in educational intervention research, where complex psychological processes are often difficult to capture through single measures.

Beyond simply strengthening confidence in findings, each methodology provided unique contributions to understanding the intervention's impact. The pre-post assessment offered standardized measurement of change across well-validated constructs, enabling comparison with broader literature and establishing objective evidence of improvement. The benefit analysis captured students' conscious perceptions of impact, revealing which effects were most salient and meaningful from their perspective. The thematic analysis illuminated the lived experience of participants, offering insights into how students integrated course concepts into their understanding of themselves and their academic journeys.

This complementarity was particularly evident in understanding the process dimension of the intervention's impact. While the pre-post assessment and benefit analysis primarily captured what changed, the thematic analysis provided crucial insights into how these changes unfolded in students' lives and meaning-making processes. For example, the evolution from separate skills to integrated capabilities observed in the testimonials helps explain how the various quantitative improvements might work together synergistically rather than

as isolated changes.

The integration of methodologies also enhanced interpretation by helping distinguish between core impacts that remained consistent across cohorts and impacts that showed more variability or evolution. This distinction is valuable for identifying the most reliable effects of the intervention while also recognizing areas where implementation differences or cohort characteristics might influence outcomes.

### ***B. Evidence for Intervention Evolution***

One of the most striking findings from the integrated analysis is the convergent evidence across all three evaluation approaches suggesting improvements in the intervention's effectiveness over time. This pattern appears particularly robust because it emerged independently in each methodology rather than being an artifact of any single approach.

The pre-post assessment revealed that the 2024 cohort showed the most comprehensive improvements across measurement frameworks. While earlier cohorts demonstrated significant positive changes in selected dimensions, the 2024 cohort showed broader and often stronger improvements across multiple measures. This pattern suggests that the intervention may have become more effective at addressing diverse aspects of well-being and psychological resources simultaneously.

Similarly, the benefit analysis demonstrated that the 2024 cohort reported higher rates of benefits across nearly all categories. The average percentage of students reporting benefits increased from around 50-54% in earlier cohorts to nearly 66% in 2024. Particularly notable were the dramatic increases in reporting "an improved mindset" and "learning new coping skills," suggesting these components may have been substantially strengthened in later implementations.

The thematic analysis complemented these findings by revealing how students' engagement with the intervention deepened over time. Later cohorts demonstrated more sophisticated integration of concepts, more transformative narratives, and greater application to specific challenges and future contexts. This evolution suggests not just more benefits but qualitatively different and potentially more impactful forms of engagement with the intervention.

This convergent evidence strengthens the case for genuine enhancement of the intervention's impact over time. Several factors may contribute to this evolution:

First, the program content and structure may have been refined based on experience and feedback from earlier cohorts. Such iterative improvement is a hallmark of effective educational interventions, with each implementation providing opportunities to identify strengths to amplify and challenges to address.

Second, delivery methods and facilitation approaches may have improved as instructors gained experience with the intervention. The effective implementation of psychological resource interventions often depends not just on content but on how that content is presented and discussed, with instructor expertise developing over multiple iterations.

Third, institutional knowledge about effective implementation strategies may have accumulated over time. As the

intervention became more established within the Extended Curriculum Program, supporting structures and processes may have better aligned to reinforce its impact.

Fourth, changing student expectations based on peer experiences may have influenced receptiveness to the intervention. As the course developed a reputation among students, later cohorts may have approached it with greater openness or clearer expectations.

While we cannot definitively determine which of these factors contributed most significantly to the observed evolution, the consistent pattern across evaluation methodologies suggests a genuine enhancement of impact rather than merely cohort differences or measurement artifacts.

### ***C. Theoretical Implications***

The integrated findings from this multi-method evaluation inform theoretical understanding of psychological resource interventions in higher education in several important ways.

The convergent evidence for mindset transformation leading to broader improvements supports theories positioning psychological resources as developmental catalysts [16], [11]. Growth mindset, in particular, emerged as a consistently strong impact across all cohorts and evaluation methodologies. This aligns with Dweck's theory that mindset serves as a foundational belief system that influences how individuals approach challenges, respond to setbacks, and engage with learning opportunities [6]. The findings suggest that developing a growth mindset may create cascading positive effects across other psychological resources and well-being dimensions, potentially serving as a gateway resource that facilitates broader development.

The evolution from separate skills to integrated capabilities observed in the thematic analysis, alongside improvements across multiple domains in the pre-post assessment, suggests effective interventions should aim beyond discrete skill development toward integrated psychological resources [27], [13]. This aligns with developmental theories that emphasize integration and complexity as markers of psychological maturation. Rather than simply accumulating isolated skills or knowledge, students appear to benefit most when they can integrate these resources into coherent approaches to academic and life challenges.

The improvements across diverse well-being dimensions support theories emphasizing the interconnectedness of psychological, social, and emotional well-being [22], [19]. The finding that improvements often spanned multiple dimensions of EPOCH well-being and flourishing suggests these constructs may function as an interconnected system rather than independent domains. This interconnectedness aligns with recent theoretical developments in well-being research that emphasize holistic approaches over siloed interventions targeting isolated aspects of functioning.

The improvements we observed across multiple dimensions of well-being align with Keyes' dual-continua model of mental health, which posits that positive mental health (flourishing) represents more than the absence of mental illness and contributes uniquely to functioning [20]. Keyes

and colleagues [21] found that college students with higher levels of flourishing demonstrated better academic outcomes and fewer mental health problems. Our findings extend this work by demonstrating how targeted interventions can enhance multiple dimensions of flourishing simultaneously, particularly for students navigating the challenges of extended curriculum programs.

The evolution toward more transformative narratives in later cohorts resonates with theories of transformative learning [28], which suggest that significant educational experiences can catalyze fundamental shifts in how individuals understand themselves and their world. The increasingly profound narrative shifts observed in the 2024 testimonials suggest the intervention may have developed greater capacity to facilitate perspective transformation rather than merely skill acquisition.

#### *D. Comparative Effectiveness with Similar Interventions*

The findings from our multi-method evaluation align with but also extend results from similar psychological resource interventions in higher education settings. Like Yeager et al.'s growth mindset intervention [11], we found significant improvements in students' beliefs about the malleability of abilities. However, while their brief intervention primarily targeted academic outcomes through a singular focus on mindset, our more comprehensive approach demonstrated improvements across multiple dimensions of well-being and psychological resources simultaneously. This suggests potential advantages to integrated approaches that address interconnected psychological constructs rather than targeting them in isolation.

Our finding that the Grow a Gritty HERO's Mindset course supported students' sense of belonging and social connection parallels outcomes from Walton and Cohen's social-belonging intervention [12]. However, our longitudinal analysis revealed an interesting evolution in how belonging integrates with other psychological resources over time—from basic acknowledgment of transition support in early cohorts to sophisticated integration of belonging with resilience and future orientation in later cohorts. This evolution suggests potential developmental sequences in how psychological resources interact that have not been extensively explored in previous research.

The comprehensive improvements in well-being dimensions we observed align with findings from Seligman et al.'s positive psychology curriculum [14] and Keyes et al.'s flourishing interventions [21]. However, our particularly strong results for the 2024 cohort suggest that iterative refinement of such comprehensive interventions may substantially enhance their effectiveness over time—a process dimension that has received limited attention in previous evaluation research.

A distinctive aspect of our findings is the evidence for developmental progression in how students engage with intervention concepts. While most evaluations of psychological resource interventions focus on pre-post changes in targeted constructs, our thematic analysis revealed qualitative shifts in how students integrated and applied concepts from basic understanding to sophisticated application. This parallels Schreiner's emphasis on developmental sequencing in thriving initiatives [13] but provides more detailed evidence for how this development unfolds through students' own narratives.

These comparisons suggest that while discrete psychological resource interventions can produce meaningful effects, integrated approaches tailored to specific student populations may offer additional benefits, particularly when refined over time based on evaluation data. They also highlight the value of mixed-methods evaluation approaches that can capture not only whether interventions work but how they work in the lived experiences of students.

Our findings also align with those from the FLOURISH Project at the University of Toronto, which implemented a similar strengths-based resilience approach but across multiple educational settings [15]. Their longitudinal research with over 2,900 students demonstrated that students who entered university in a flourishing state (high well-being, low stress) were twice as likely to graduate within five years as their languishing counterparts. Similarly, they found that languishing students were four times more likely to use health and counseling services. Their comprehensive approach to transition, which included assessment, peer mentorship, and group programming, parallels our framework but provides additional evidence of effectiveness at scale. The FLOURISH Project's implementation of Keyes' Complete Mental Health Model offers further validation for our theoretical framework, particularly in connecting flourishing states to concrete educational outcomes such as graduation rates [15].

#### *E. Practical Implications*

The integrated findings suggest several practical implications for designing and implementing psychological resource interventions in higher education contexts, particularly for extended curriculum programs.

The broad pattern of improvements across dimensions supports the value of comprehensive interventions that address multiple psychological resources rather than narrowly focused programs. While many interventions target single constructs like growth mindset or resilience in isolation, the Grow a Gritty HERO's Mindset course's multi-faceted approach appears to foster improvements across various domains simultaneously. This suggests that program designers should consider integrated approaches that acknowledge the interconnectedness of psychological resources and well-being dimensions.

The evolution observed in student experiences suggests interventions should anticipate and support developmental progression from basic understanding to sophisticated integration of concepts. Rather than presenting psychological resources as static skills to be acquired, interventions might be structured as developmental journeys that scaffold increasingly complex forms of engagement over time. This could involve revisiting core concepts at deeper levels throughout the intervention, providing opportunities for application and integration, and explicitly acknowledging the evolving nature of psychological development.

The strongest impacts appear to emerge from balancing personal psychological development with social connection, theoretical understanding with practical application, and present coping with future orientation. This suggests that effective interventions should maintain balance across these dimensions

rather than emphasizing any single aspect to the exclusion of others. For example, while individual reflection activities are valuable, they should be complemented by opportunities for social connection and collective meaning-making.

The persistent emphasis on transition support and belonging suggests that establishing these foundations early may create conditions for other psychological developments. This aligns with Maslow's hierarchy of needs and contemporary belonging research [12], which suggest that basic psychological needs for safety and belonging must be addressed before higher-order development can occur optimally. Interventions might therefore front-load belonging and transition support components while scaffolding more complex psychological resources later in the sequence.

The finding that effects appeared to strengthen over time highlights the value of ongoing program refinement based on evaluation and experience. Rather than implementing interventions as fixed protocols, program designers should adopt adaptive approaches that incorporate feedback and allow for evolution in response to observed outcomes and changing student needs.

#### *F. Limitations and Future Directions*

While this multi-method evaluation provides robust evidence for the impact of the Grow a Gritty HERO's Mindset course, several limitations should be considered when interpreting the findings.

The absence of control groups across all three cohorts represents a significant limitation. Without comparison groups who did not receive the intervention, changes cannot be conclusively attributed solely to the course, as other factors within the Extended Curriculum Program experience may have contributed to observed improvements. Future research should incorporate quasi-experimental or experimental designs with appropriate control conditions to strengthen causal claims about intervention effects.

The relatively small samples in each cohort ( $n=35-41$ ) limit statistical power and generalizability. While these sample sizes are adequate for detecting moderate to large effects, smaller but potentially meaningful changes may have gone undetected. The findings may also reflect the specific characteristics of these cohorts rather than representing all extended curriculum students. Future studies should aim for larger samples and explore potential moderating factors like demographic characteristics, prior academic experiences, and baseline psychological resources.

The reliance on self-selection and self-report represents another limitation. Testimonials and benefit analyses were provided voluntarily, which may have created selection bias toward students who experienced more positive outcomes. Additionally, all measures relied on self-reporting, which can be influenced by social desirability, demand characteristics, or limited self-awareness. Future research could incorporate objective measures of academic performance, behavioral indicators of well-being, or observer ratings to complement self-report data.

The absence of 2022 data creates a gap in understanding year-to-year progression. While the exclusion was necessary

due to insufficient sample size, it limits our ability to trace the continuous evolution of the intervention's impact. Future research should aim for consistent data collection across consecutive years to better understand developmental trajectories of impact.

Perhaps most significantly, the study does not directly examine relationships between psychological improvements and academic outcomes. While theory and prior research suggest that enhanced psychological resources should support academic success, this study cannot determine whether the observed improvements translated into better grades, higher retention, or other educational outcomes. Future research should explicitly investigate these relationships, ideally through longitudinal designs that can capture both immediate psychological changes and longer-term academic impacts.

To address these limitations and build on the current findings, future research should pursue several directions:

- Incorporate control or comparison groups to strengthen causal claims about intervention effects
- Examine relationships between psychological improvements and academic outcomes, including grades, retention rates, and time to graduation.
- Conduct longer-term follow-up assessments to determine the sustainability of improvements and potential sleeper effects that may emerge over time.
- Investigate which specific program components contribute most significantly to which outcomes through component analysis or dismantling studies.
- Explore potential adaptations for different student populations and delivery contexts, including variations for specific disciplines, different institutional settings, or alternative delivery formats.

Such research would further enhance understanding of how psychological resource interventions can effectively support student success, particularly for those in extended curriculum programs.

## VI. CONCLUSION

This comprehensive evaluation of the Grow a Gritty HERO's Mindset course demonstrates its effectiveness in enhancing multiple dimensions of student well-being and psychological resources across three cohorts of engineering students in an Extended Curriculum Program. By integrating pre-post assessment, benefit analysis, and thematic analysis of testimonials, we have developed a nuanced understanding of both the consistent core impacts of the intervention and its evolution over time.

The triangulation of findings across evaluation approaches provides robust evidence for several key impacts, with particularly strong convergence on mindset transformation, enhanced self-awareness and personal growth, improved resilience and coping, and development of positive psychological resources. The intervention appears to effectively promote psychological development across multiple domains simultaneously, with growth mindset emerging as a consistently strong effect across all cohorts.

The evaluation also reveals an evolution in the intervention's impact over time, with the 2024 cohort demonstrating

the most comprehensive improvements across all evaluation methodologies. This pattern suggests potential maturation and refinement of the program, highlighting the value of iterative improvement in educational interventions.

These findings contribute to our understanding of how structured psychological resource interventions can support student development during critical educational transitions, particularly for students in extended curriculum programs. The multi-faceted nature of the improvements suggests that such interventions may support not only academic resilience but also broader personal development and well-being.

The study also demonstrates the value of mixed-methods evaluation approaches for understanding complex educational interventions. The integration of quantitative and qualitative methodologies provided richer insights than any single approach could offer, highlighting both what changed and how students experienced and made meaning of those changes.

Beyond its implications for the specific context of Stellenbosch University's Extended Curriculum Program, this evaluation contributes to the broader understanding of psychological resource interventions in higher education. While previous interventions like those developed by Yeager et al [11], Walton and Cohen [12], and Seligman et al [14] have demonstrated the value of targeting growth mindset, belonging, and well-being respectively, our findings suggest potential benefits to integrated approaches that address multiple psychological resources simultaneously. The evolution of impact observed across cohorts also highlights the importance of iterative refinement based on evaluation data, a process often underemphasized in intervention research. As institutions globally seek to support diverse student populations, particularly those in extended or transitional programs, the principles and practices embodied in the Grow a Gritty HERO's Mindset course offer promising directions for holistic student development.

As higher education continues to seek evidence-based approaches to supporting diverse student populations, comprehensive psychological resource interventions like the Grow a Gritty HERO's Mindset course offer promising pathways for enhancing student success and flourishing. By developing psychological resources and well-being in a holistic manner, such interventions may help students navigate the challenges of extended curriculum programs while developing capacities that will serve them throughout their academic journeys and beyond.

## APPENDIX A

### USING CLAUDE FOR THEMATIC ANALYSIS OF STUDENT TESTIMONIALS

#### Introduction to AI-Assisted Qualitative Analysis

This appendix describes the process of using Claude, an AI assistant developed by Anthropic, to conduct a thematic analysis of student testimonials collected from the Grow a Gritty HERO's Mindset course. While traditional thematic analysis involves manual coding and analysis by human researchers, this project explored how AI tools might support and enhance qualitative research processes while maintaining methodological rigor.

## Methodology

### 1. Data Preparation

Prior to analysis, student testimonials were:

- Anonymized to remove identifying information
- Organized by cohort (2021, 2023, 2024)
- Converted to text format compatible with AI analysis

### 2. Analysis Process

The thematic analysis followed Braun and Clarke's [26] six-phase approach but integrated AI assistance at specific stages:

#### Phase 1: Familiarization with Data

Complete testimonial datasets were provided to Claude. Claude performed initial reading and summarization of the data corpus. The researcher also independently read all testimonials to ensure familiarity.

#### Phase 2: Generating Initial Codes

Claude was instructed to identify recurring concepts using the prompt: "Please identify recurring concepts, themes, or patterns in these student testimonials about the Grow a Gritty HERO's Mindset course. Focus on how students describe their experiences and benefits. Provide evidence for each concept with representative quotes." Claude generated initial code lists, which were then reviewed by the researcher. The researcher refined and adjusted codes based on knowledge of the course content and context.

#### Phase 3: Searching for Themes

Claude was provided with the refined codes and instructed to group them into potential themes: "Based on these identified codes, please suggest potential overarching themes that capture related concepts. For each potential theme, explain its meaning and provide supporting evidence from the testimonials." Claude generated candidate themes with supporting evidence. The researcher reviewed these for coherence and alignment with the research questions.

#### Phase 4: Reviewing Themes

The researcher provided feedback on candidate themes. Claude refined themes based on feedback and conducted further analysis of how themes manifested across different cohorts: "Please review these themes for internal homogeneity and external heterogeneity. Are there distinct patterns in how these themes appear across the 2021, 2023, and 2024 cohorts? Provide evidence for any longitudinal patterns you observe."

#### Phase 5: Defining and Naming Themes

The researcher and Claude collaboratively refined theme definitions and names. Claude provided suggestions for clearly articulating the essence of each theme: "For each finalized theme, please provide a clear definition that captures its essence, a descriptive name, and an explanation of how this theme evolved across cohorts if applicable."

#### Phase 6: Producing the Report

Claude generated initial theme descriptions with supporting evidence. The researcher edited and integrated these into the final report. The evolutionary patterns across cohorts were specifically highlighted.

### 3. Quality Assurance Measures

To ensure methodological rigor despite the integration of AI, several quality assurance measures were implemented:

**Human Oversight:** All AI-generated analyses were reviewed by the researcher, who maintained final decision-making authority

**Triangulation:** AI-identified themes were cross-checked against quantitative findings from pre-post assessments and benefit analyses

**Transparency:** The use of AI was explicitly acknowledged, and the process documented (in this appendix)

**Reflexivity:** The researcher maintained awareness of how AI might influence the analysis and regularly reflected on potential biases

#### 4. Strengths and Limitations

##### Strengths of AI-Assisted Thematic Analysis

Ability to process large volumes of text quickly  
Reduction of certain forms of human bias  
Systematic identification of patterns across large datasets  
Capacity to identify subtle linguistic patterns across cohorts  
Generation of comprehensive evidence for each theme

##### Limitations

Potential for AI to miss culturally specific or contextual nuances  
Limited ability to incorporate non-textual cues  
Dependence on the quality of prompting and human oversight  
Possible reinforcement of patterns initially identified

#### 5. Reflection on the Process

The integration of Claude into the thematic analysis process proved valuable in several ways. The AI was particularly effective at identifying recurring patterns across large volumes of text and suggesting potential relationships between concepts. It excelled at systematically tracking how themes evolved across different cohorts, which helped illuminate the longitudinal development of the intervention's impact.

However, human oversight remained essential. The researcher's contextual knowledge of the Grow a Gritty HERO's Mindset course, the Extended Curriculum Program, and the specific institutional context at Stellenbosch University provided critical interpretive insight that the AI lacked. Additionally, the researcher's theoretical foundation in positive psychology, growth mindset theory, and student development frameworks helped situate the identified themes within relevant literature.

This hybrid approach—combining AI's pattern recognition capabilities with human contextual understanding and theoretical knowledge—represents a promising methodological direction for qualitative analysis of educational interventions.

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