

How and Why Women Leave Engineering Careers: Toward an Integrated Framework of Counseling and Organizational Psychology Career Theories

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Abstract

Women leave the engineering profession at higher rates than men; thus, exacerbating their underrepresentation in the field. The purpose of this paper is to increase our understanding of women's engineering career decisions, including how and why their career plans change over time, therefore, contributing to the conversation on the underrepresentation of women in the engineering profession. Both counseling and organizational psychology theories have informed previous studies of the career plans of women in engineering. However, theories from these two disciplines were not yet fully integrated, and many questions remain. This paper provides a potential framework to integrate concepts of an organizational psychology theory (unfolding model of turnover), a traditional counseling psychology theory (career construction), and a third theory that spans both disciplines (person-environment fit). In this manner, I conceptualize an idea for moving across traditional boundary lines to explore new ways of thinking about engineering career decisions. Moving towards integrating counseling and organizational psychology theories broadens our understanding of how and why women's engineering career plans change over time. In this paper I describe a specific application of the framework to my research on how and why women leave the engineering profession; however, the framework is also useful in studying women's career decisions at any developmental stage (early career ideas; selecting engineering careers, and majors; persisting in engineering academic programs; leaving/ staying in the profession, etc.). Research using this framework has the potential to narrow the gap between the disproportional percentage of women bachelors' in engineering graduates vs. women engineers practicing in the workplace. Furthermore, this knowledge informs the career decisions of women engineers and those considering engineering as a profession; and guides advisors, mentors, and career counselors in identifying new ways to support these women along their career journey (early career ideas; exploration; selecting engineering careers, and college majors; persistence; and leaving/ staying in engineering careers).

Leaving Engineering: Our Current Understanding

Women's continued underrepresentation in the engineering workplace remains yet to be fully understood. Women are pursuing engineering majors in increased numbers [1] and persevering in these programs at rates comparable to men [2]. Despite advances in the recruitment and retention of women in engineering, the percentage of women working in the field has remained constant [1]. One contributing factor may be that women are leaving the engineering profession at higher rates than men [3]. Specifically, more than two-thirds of women leave the engineering profession within fifteen years of graduation, whereas men leave at less than half that same rate [4]. High turnover in a specialized technical field such as engineering, which requires rigorous education and training, can be costly to society, organizations, and individuals [1], [5]. While we know much about the experiences of women in engineering, we are less clear about how these experiences contribute to their decisions to leave the profession. Gaining a deeper, more robust understanding of how and why women decide to leave the field of engineering may be advantageous in addressing the broader question of the continued underrepresentation of women in the engineering workplace.

A limited number of studies exist that directly address why women leave engineering careers after having worked in industry. Upon a review of these studies and the related literature on women in STEM [6] - [8], male-dominated professions [9], and the culture of engineering [10] [11], I have identified three buckets of factors that influence women's decision to leave the engineering profession after working in industry: *work environment* [12] - [14], *family-work balance* [4] [15] [16], and *personal factors* [1] [17]. Additional details about these buckets of factors, sub-factors within, and the process by which these categories were derived, will be included in my future work. While the reviewed literature significantly contributes to our overall understanding of the experiences of women in engineering and STEM careers, many questions remain. Additionally, little has been studied or is well-known about the underlying processes that describe how women leave the profession; questions that are challenging to answer with cross-sectional data.

Despite career planning being a process, few empirical studies have examined women's engineering career decisions over time. Studies instead have focused primarily on one transition point (e.g. selecting an engineering major, transferring from engineering programs, leaving the engineering profession). We have learned a lot about how and why women pursue and persist in engineering academics; however, few studies have attempted to establish a connection between these early-career choices and women's later decisions to either leave or stay in the profession. Examining women's career decisions over time could increase our understanding of why some women leave the engineering profession after having worked in industry. To undertake this endeavor requires a comprehensive career decision framework covering the life span.

Leaving Engineering: Expanding Our Understanding

For years organizational psychologists have extensively studied how and why individuals leave jobs. Given a career is a series of jobs, many turnover theories may apply to the study of women's engineering career outcomes. Some researchers have considered a turnover theory (theory of workplace adjustment, work engagement, etc.) in their study of women in engineering [1], [4], [18] - [21]. However, comprehensive integration of knowledge from the existing organizational turnover theories has not yet occurred. For example, the unfolding model of turnover thus far has only been applied conceptually to leaving engineering [22]. However, it has already been utilized as a framework to study the career decisions of a variety of professionals such as nurses, accountants, construction workers, military, and IT professionals [23] - [30]. Details of the utility of this theory in understanding women's engineering career decisions are included in the latter part of this paper.

Considering concepts from the industrial and organizational psychology (I/O psychology) literature adds to our understanding of how and why women leave the engineering profession. I have extensively reviewed both bodies of literature and paired concepts from industrial and organizational psychology (I/O psychology) with the environmental, family-work balance, and personal factors that influence women's decisions to leave the engineering profession. Detailed findings and the process of this pairing will be included in my subsequent work. In this paper, I conceptualize an idea for moving across traditional boundary lines to explore new ways of thinking about engineering career decisions by integrating concepts from counseling and organizational psychology.

Proposed Theoretical Framework

In this section, I provide a potential framework that integrates concepts of an organizational psychology theory (unfolding model of turnover), a traditional counseling psychology theory (career construction), and a third theory that spans both disciplines (person-environment fit). I first provide an overview of the career construction theory, the unfolding model of turnover, and the person-environment theory, three theories that inform our understanding of how and why women leave engineering careers after working in the profession. I conclude this section with a conceptualization of my proposed framework (Figure 1).

Career Construction Theory

The career construction theory (CCT) centers around the construct of career maturity (the readiness to take on career development tasks at hand), and the idea that career maturity progresses along a continuum of developmental tasks expected at a given chronological age [32]. According to CCT, women in engineering progress through growth, exploration, and establishment stages as they develop and modify their career plans from birth through entry into the engineering profession [32], [35], [36]. Progression through these stages involves developing and implementing one's vocational self-concept by translating one's view of self into occupational terms and then preparing for and performing that occupation [70]. Vocational self-concept, the self-perceived qualities that an individual considers relevant to work roles, develops through the interaction of inherited abilities, physical make-up, opportunities to observe and play various roles, and evaluation of the extent to which the role-playing receives approval from others [32], [70].

CCT maintains that career development is comprised of a life-long series of decisions that occur as individuals progress through the stages of career development, often non-linearly with recycling back to previous stages. This developmental stage model is a simplification of reality, designed to provide a general idea of what to expect at a given age range, based on biological maturation and age-related social experiences. Career maturity is evaluated by comparing the tasks an individual encounters with those defined in the stage model. Career development (construction) occurs as individuals move towards the mental picture of their ideal occupation, or ideal self-concept [35], [36]. A series of matching decisions guide this process as individuals attempt to attune their inner and outer worlds [35], [70].

Cultural scripts about gender, race, ethnicity, and class influence the development of an individual's vocational self-concept [35]. As individuals observe and play various roles, social expectations and feedback from others (peers, parents, supervisors) may strengthen or modify their vocational self-concept. An individual's views of self and work, characteristics of the world of work, and societal expectations are always changing; therefore, the internal striving towards the ideal self-concept is never fully actualized. In summary, developing a vocational self-concept is an adaptive and iterative process that occurs over the life span as individuals make a series of matching decisions. Implementing one's ideal vocational self-concept enables individuals to be who they want to be; thus, promoting higher career and life satisfaction [32], [35], [36]. More recent revisions of the career construction model further emphasize the vital role of agency and adaptability (resources and readiness to cope with career development tasks) as individuals construct their careers [37], [38].

Unfolding Model of Turnover

The unfolding model of turnover (UMT) [39] considers multiple pathways to turnover, described by shocks (jarring events), scripts (plans of action that may be self-authored or guided by the expectations of others), and image violations (violation of goals and values). This model differs from more traditional turnover models [40] - [43], based on job satisfaction as the primary antecedent to turnover [44]. While UMT is primarily used to describe organizational turnover (exit from a company or corporation), the concepts of shocks, scripts, and image violations are also useful more broadly in describing vocational turnover (exit from a profession). Adapting the model for use in studying vocational turnover also requires adapting the constructs within the model.

Here I define shocks, scripts, and image violations for use in the framework outlined in this paper. Shocks are distinguishable events that cause an individual to pause and reflect on their life or career decisions. They can be positive, neutral, or negative; expected or unexpected; internal or external to self-and/or the work environment. Scripts are career-related plans of action based upon experience, observation of others, materials read, social expectations, and/or family rules/norms, etc. Image violations are the incongruity perceived by an individual between their interests, values, goals, strategies for goal attainment, and their environment (family, school, peers, employer) or specific career.

Image violations result when an individual's values, goals, and strategies do not fit (are incongruent) with those of an organization [or profession]; if these differences are irreconcilable, thoughts of leaving may occur [27]. Individuals make decisions based on a screening process that utilizes specific threshold criteria held in their images for work, family, friends, recreation, ethics/spirituality (for additional details on image theory refer to Beach [45] and Lee & Mitchell [39]). Because this screening process centers around the violation of fit [46], subsuming relevant concepts from person-environment fit theories into the unfolding model of turnover is warranted. However, I elaborate on aspects of this theory here to further explicate the direct contributions of the person-environment fit later.

Person-Environment Fit Theory

Person-environment fit theories assume people seek out and create environments congruent with their traits and that congruency is associated with better outcomes [47], [48]. P-E fit is a multi-level construct encompassing fit between the person and organization (P-O), person and job (P-J), person and workgroup (P-G), and person and supervisor (P-S) in addition to fit between person and vocation (P-V). I located two studies of women leaving the engineering profession that utilized one P-E fit theory, Theory of Workplace Adjustment (TWA). These studies found that women leave the engineering profession due to a mismatch between their needs and workplace values [1] and confirmed that gender differences exist in their reasons for leaving [19]. Findings from other studies on workplace factors suggest the exploration of fit, especially P-S and P-V fit, may prove advantageous. In career counseling theory and practice, many dimensions of fit are assessed (fit of the individual's interest, ability, values, personality, experiences, etc. to the environment) as individuals make their career choices [32]. Similarly, a model to understand why women leave the engineering profession needs to be comprehensive, incorporating many of these same dimensions. Others such as Su et al. [48] and Armstrong et al. [49] have called for such an integrated model of fit.

One type of P-E fit, interest congruence, is useful in understanding how and why women decide to leave the engineering profession. Interest congruence is a secondary construct of the theory of vocational personality [50]. It is a construct that provides insight into the dynamic process of accommodation, a process whereby people select environments based on their preferences, and simultaneously these environments also influence how individuals develop [50] - [52]. Environments exert influence on individuals by reinforcing specific behaviors and values. Accommodation occurs, and congruence increases by four different processes: 1) contextualization/ correlated change (stabilization of personal and environmental characteristics), 2) reactive adjustment/ socialization (individual changes to adapt to the environment), 3) active adjustment/ accommodation (individuals change their surroundings to fit themselves; job crafting), 4) quitting (individual leaves to find a better fit elsewhere) [51]. Further exploration of congruency and accommodation demonstrates promise in answering how and why women leave the engineering profession after working in industry.

Towards an Integrated Framework

The career plans of women engineers change over time. It is useful to understand how and why their plans change such that we can gain a better understanding of how and why some women decide to leave the engineering profession after having worked in industry. The factors that influence why women leave the engineering profession are complex and multifaceted. The underlying mechanisms that describe how women leave are even more nuanced. Many theories explain aspects of how and why women leave engineering; however, a comprehensive model that pulls these aspects together cohesively has not yet been identified.

A theoretical framework based on concepts from the career construction theory, the unfolding model of turnover, and P-E fit theory adds to our understanding of how and why women's engineering career plans change over time. Conducting a study using this framework has the potential to provide additional insight into why women decide to leave the engineering profession after initially choosing engineering as a career. Integration of these three theories brings together relevant aspects from career development, vocational counseling, and organizational psychology. The unfolding model of turnover subsumes many concepts from P-E fit theory; however, a full encompassing into the unfolding model of all that the P-E fit brings to the conversation has not yet been achieved; thus, P-E fit is considered a third distinct theory.

The framework in Figure 1 provides a start towards the integration of the three theories described above. This representation draws heavily upon the work of Zimmerman, Swider, Woo, and Allen [53], who have already integrated many of the existing I/O psychology theories that are relevant to my research regarding how and why women leave the engineering profession. Their work includes P-E fit as part of the goals/ values affective unit. However, the framework I propose places "fit"(image violation) more central in the model. I place "fit" in this central position because of its driving force in career decision making and because of its recurrence across the career development literature, organizational psychology theories, and within the three buckets of factors that describe why women leave the engineering profession.

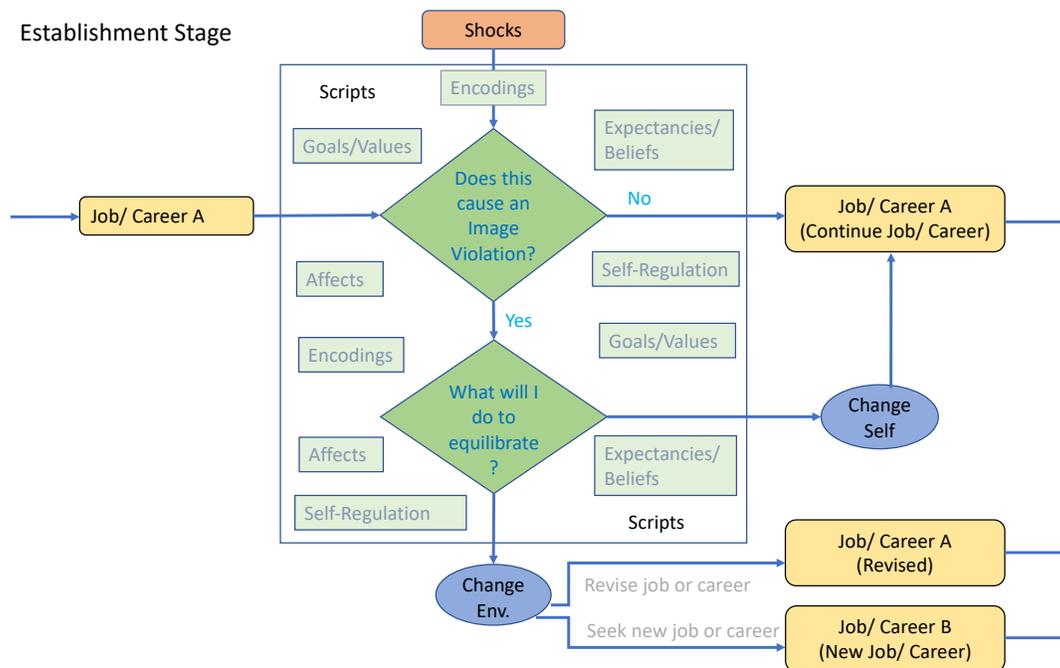


Figure 1. Towards an integrated framework of vocational departure (establishment stage).

The above framework includes shocks, scripts, and image violations from Lee & Mitchell’s [39] UMT. Lee and Mitchell [39] consider three types of image violations (values, goals, and strategies); whereas my proposed model also considers additional types of violations that result from incongruity between an individual’s interest, abilities, personality, values, experiences, and/ or work environment. For a broader conceptualization of fit, I incorporate the cognitive-affective units (encodings, expectancies & beliefs, affects, goals & values, competencies & self-regulatory plans) described by Zimmerman et al. [53]. Cognitive-affective units influence and interact with each other in a variety of ways and are accessed as individuals encounter specific situations and then determine how to respond [53]. Similarly, cognitive-affective units influence an individual’s interpretation of shocks and the determination of fit [39].

Scripts, or career-related plans of action, and related constructs, including the cognitive-affective units, are displayed together in the green shaded box in Figure 1. These concepts involve executive control, “the ability to coordinate thought and action and direct it toward obtaining goals” [54]. The decision making required to implement scripts is dependent upon the core executive functions of inhibition (interference control, self-control) and cognitive flexibility (changing perspectives of a problem, task switching, adjusting to new situations) as well as higher-order functions including reasoning, problem-solving, and planning [54] - [56]. One of the affective units displayed in the model, self-regulation, requires the executive function of inhibition [56]. All of the cognitive-affective units are presumed to be related to the core or higher-order executive functions defined by Diamond [56]; however, specific details of how they interact and influence each other are beyond the scope of this current model.

Individuals are internally wired with a drive towards congruency, or fit. When fit does not exist, individuals strive to create it by changing themselves or their environment. Scripts can be used by individuals to navigate towards congruency through goal-striving. However, an individual's willingness to engage is dependent on individual differences such as personality and proactivity, factors that also influence whether or not individuals will engage in job crafting. The model in Figure 1 is not complete; instead, it provides a modest start towards a comprehensive conceptualization and serves as a starting point for future studies. Knowledge and insight gained in such studies will further contribute to the development of this integration model.

The career journey involves a series of education, job, personal, and career-related decisions; however, the vocational departure framework (establishment) in Figure 1 represents one of three snapshots comprising the proposed 3-phase model based on the career construction theory (growth, exploration, and establishment). Shocks, scripts, and image violations throughout all three phases influence and build upon future and previous shocks, scripts, and image violations. Thus, a women's decision to leave the engineering profession is represented best by a phase-type model. Appendix A contains an overview of the 3-phase career journey model (A1) and individual snapshot representations for each phase (A2 -A4). While all phases of the model are useful to my research on the career decisions of women in the engineering profession, the individual phases of the model, such as growth (A2) and exploration (A3) could also be used directly to study other career decisions including early career ideas and selection of a career and college major.

Discussion

The proposed framework based on the unfolding model of turnover (UMT) and the career construction theory (CCT) contributes to our understanding of women's engineering career decision-making. UMT is useful for studying women's engineering career decisions because it specifically addresses adults in the workplace, whereas other theories of engineering career decision-making do not. This model has been tested with a wide variety of workers, including nurses [26] [28], accountants [23] [27], construction professionals [25], military officers [24], and IT professionals [29] [30]. To my knowledge, UMT has not been empirically tested with engineering populations; however, it was utilized as a conceptual model for HR interventions with engineering professionals [22]. Thus, we have no reason to believe it would not be equally valid with engineering as it has been with other populations.

Another contribution of UMT is that leavers' pathways can be classified fairly accurately with only a few constructs. For example, using UMT as a framework, Lee et al. [27] classified 92.6% of accountants who left their jobs into one of four pathways. Donnelly and Quirin [23] similarly classified 91% of accountants. With extensions to the model, 89% of construction workers [25] and 78% of IT professionals [29] were also classified. Additionally, existing studies confirm the significant role of shocks in the leaving process. For example, the majority of nursing leavers (58%) report a shock influenced their decision to quit [26]. Similarly, Jones et al. [25] found that shocks significantly influenced most construction workers' (81%) final decisions to leave. UMT adds to our understanding of engineering career decisions in the workplace. Understanding the role of shocks, scripts, and image violations in engineering career decisions provides insight about how and why women's engineering career plans change over time and likewise, their eventual decision to leave (or stay in) the profession.

Developmental career theories (e.g. CCT) contribute to our understanding of engineering career decisions across the lifespan, whereas some theories are useful for engineering career decisions at a particular career stage (e.g. social cognitive career theory [SCCT] for selection and persistence in engineering majors; UMT for leaving engineering jobs and careers). While the testing of the developmental self-concept theory weighs heavily on adolescents, we see some evidence of the theory's validity across the life span, including early childhood [57] and throughout the later career stages [58]. Viewing career decisions developmentally connects the parts (various career decision steps) into a whole (career journey), thus providing a broader context for understanding the individual career decision points. CCT, in particular, adds value over more traditional developmental career theories as it focuses directly on the agency of the individual in constructing their career, yet also considers the role of societal influences on career decisions. Career adaption, one of the central aspects of this model, provides a mechanism for studying the behaviors that individuals require in navigating through the developmental activities (individual planning) and the unexpected events that may occur (responsive actions). The individual and environment are in a constant state of flux; therefore, career decision-making is an ongoing match (PE-fit) between the individual and the environment.

Although some argue that the propositions of the model are not easily testable [59] - [61], CCT provides a cohesive framework for explaining and interpreting research findings [35], [62]. The model is both theoretical and practical as it useful in identifying steps individuals and career counselors can take to facilitate progress through the developmental stages. CCT has been utilized as a framework to study career decisions of a wide range of populations, including adolescents [63]; career counselors [64]; and multiple generations [65]; as well as populations outside of the US such as older adults in the United Kingdom [66], workers in Switzerland [67], and refugees in Germany [69]. I was unable to locate empirical studies with engineering populations that utilize this theory as a framework. However, because CCT has been tested and validated with diverse populations, we can reasonably assume this theory may be equally useful in understanding women's engineering career decisions over their life span.

The theories described are not inherently contradictory, thus it is possible to include aspects from each. In this way, the contributions of one theory can be used to close the gaps left open by the limitations in the other theories. The decision about which components to incorporate from each model depends on the desired research questions. For my study on how and why women leave the engineering profession, I proposed a framework using the career construction theory as an overarching theory while incorporating aspects of UMT (shocks, scripts, image violations) across the life span to explain the eventual decisions of women to leave the profession. Future research could also benefit from examining how aspects of SCCT (e.g. self-efficacy, outcome expectations, interests, goals setting, supports/barriers) could be incorporated into the proposed framework. Another possibility for integration is to identify overlapping constructs and use theory and knowledge from multiple models to gain a broader understanding of those particular constructs. For example, P-E fit motivates the career decision process in both CCT (through the match process that occurs while striving towards the ideal vocational self-concept) and UMT (through the image violation screening process). While P-E fit is not central to the SCCT model, the authors acknowledge PE-fit plays a role in career decision-making and incorporate these ideas into their theory [31], [34], [68]. Additionally, in their latest extension of SCCT (model of career-self management), Lent and Brown [33] acknowledge the importance of a developmental

approach in understanding the career decision-making process, and subsequently, incorporate the adaptive career behavior construct from developmental self-concept theory and CCT.

Conclusion & Implications

In this paper, we explored studying women's engineering career decisions through a novel framework that integrates theories from organizational and counseling psychology. This theory-integration work continues the work of others who have also called for a more integrated framework to study career decisions [33], [68]. As we move forward to develop an integrated framework, we will more clearly understand women's engineering career decisions across the life span. Ideas for integrating the theories have been provided and a framework was proposed to integrate an organizational turnover theory (unfolding model of turnover) with a traditional counseling theory (career construction) and a third theory that spans both disciplines (PE-fit). Moving towards integrating counseling and organizational psychology theories in this manner broadens our understanding of women's engineering career decisions.

The proposed framework is developmental in nature, and thus provides a mechanism for us to connect what we know about women's engineering career decisions at various points in life. For example, while we have extensive knowledge about how women select and persist in engineering majors, we know little about how these choices connect with women's early engineering career ideas and/ or their engineering career decisions in the workplace. Using developmental theories allows us to see the whole career trajectory, not just the parts, when studying women's engineering career decisions. This allows us to connect previous literature about engineering career decisions at the various transition points such as early career ideas, selection of engineering careers and majors, academic persistence, and leaving/ staying in the profession. Since the ultimate goal is to lessen the underrepresentation of women in both engineering academic programs and the engineering profession, the proposed framework has the potential to enlighten our understanding of both areas, while also providing a deeper understanding of their interconnectedness.

Adapting the unfolding model of turnover theory (organizational turnover) to study how and why women leave the engineering profession (vocational departure) is a natural starting point for introducing this theory into the study of women's engineering career decisions. However, given that career development occurs over a person's lifespan, it is plausible that concepts from this theory (shocks, scripts, and image violations) apply to decisions at other stages of career development, including early career ideas, career selection, and choice of college major. Models for these stages are included in Appendix A. Future research to examine the role of shocks, scripts, and image violations in understanding how and why individuals modify their early career ideas and their initial college/ career choices would be advantageous. Research using this framework has the potential to narrow the gap between the disproportional percentage of women bachelors' in engineering graduates vs. women engineers practicing in the workplace. Furthermore, this knowledge informs the career decisions of women engineers and those considering engineering as a profession; and guides advisors, mentors, and career counselors in identifying new ways to support these women along their career journey (early career ideas; exploration; selecting engineering careers, and college majors; persistence; and leaving/ staying in engineering careers).

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Appendix A

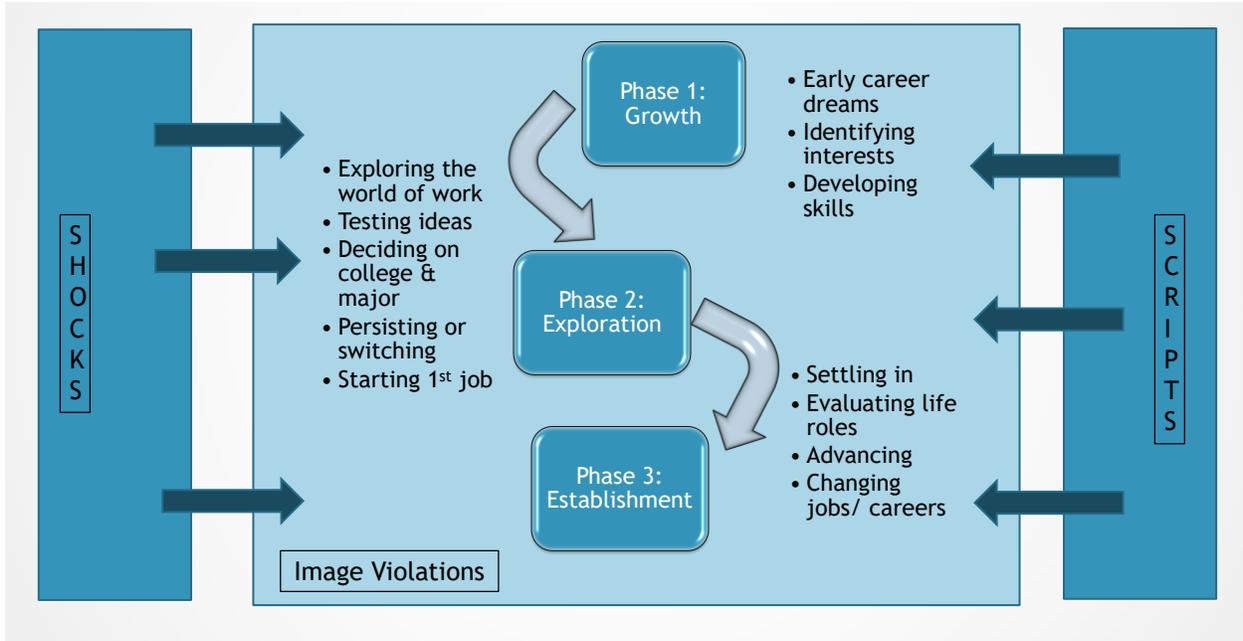


Figure A1. Three-phase career journey with shocks, scripts, and image violations.

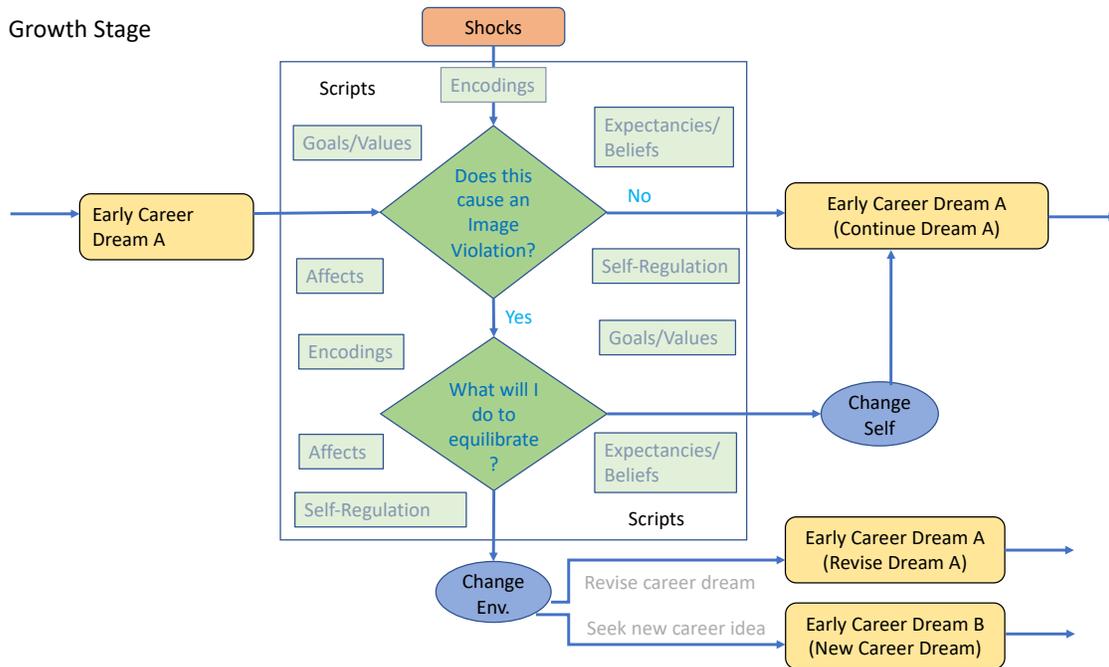


Figure A2. Towards an integrated framework of vocational departure (growth stage).

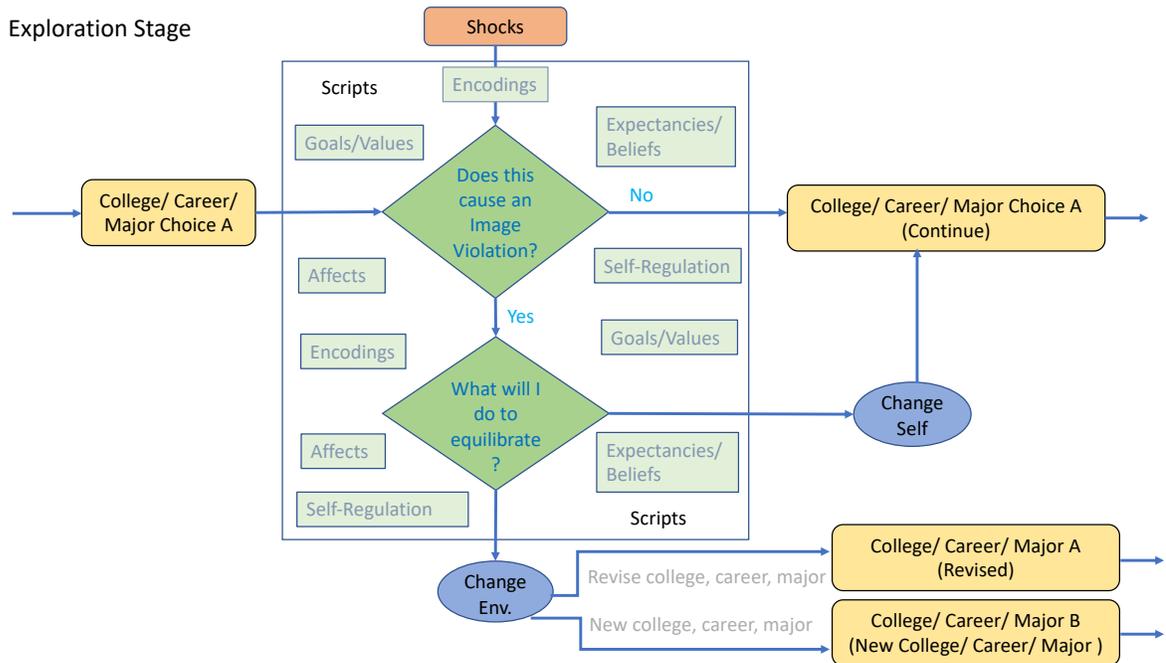


Figure A3. Towards an integrated framework of vocational departure (exploration stage).

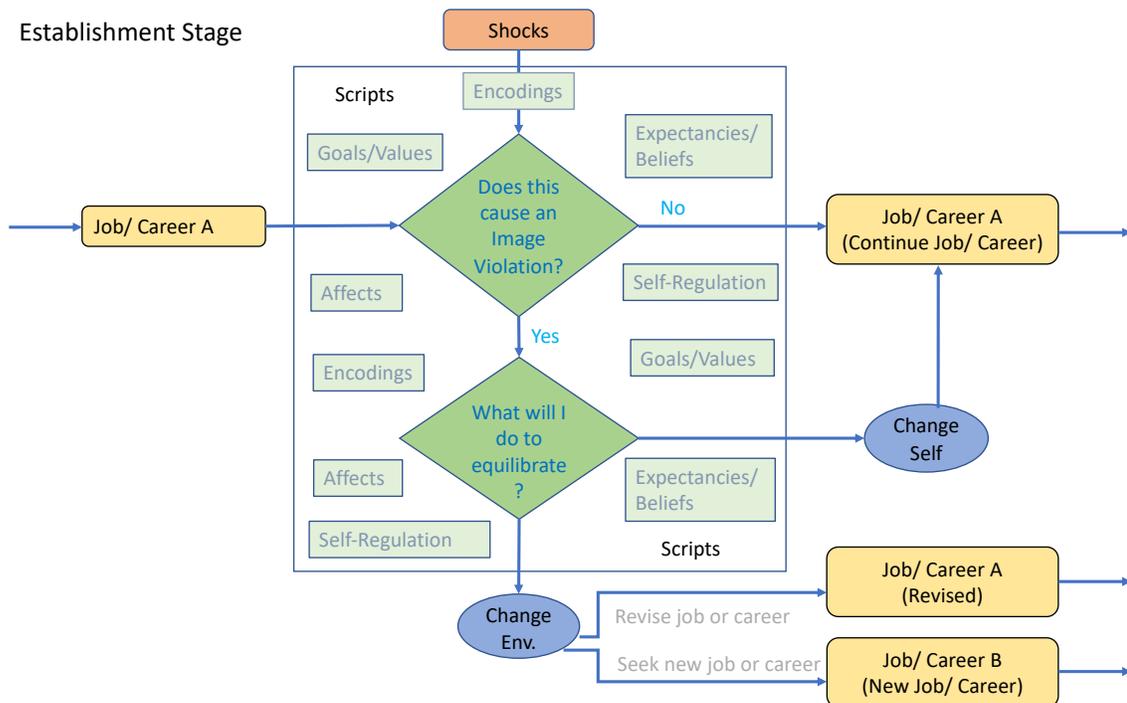


Figure A4. Towards an integrated framework of vocational departure (establishment stage).