



# To entrepreneur or not to entrepreneur? How identity discrepancies influence enthusiasm for academic entrepreneurship

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## Abstract

Recognizing the commercial potential of university-based inventions and discoveries, legislators and administrators have called upon academic scientists to become academic entrepreneurs. Yet, few academic scientists appear enthusiastic about taking on entrepreneurial activities. The intrinsic reasons underlying the lack of enthusiasm are poorly understood. We extend the research by applying self-discrepancy theory to explore the role of future-oriented self and other guides on enthusiasm for academic entrepreneurship. Integrating self-discrepancy theory with social identity theory, we also examine the moderating effects of scientist identification and academic entrepreneur social identification. We test our model on a sample of National Science Foundation (NSF) funded academic scientists who participated in the Innovation Corps (I-Corps) entrepreneurship training program. We find academic scientists' self-guides influence their enthusiasm for academic entrepreneurship, while interestingly, their other-guides do not. Additionally, we find that higher identification with a scientist identity enhances the positive effect of the self-guide on entrepreneurial enthusiasm while higher identification with an academic entrepreneur identity attenuates the positive effect. Our paper contributes to the academic entrepreneurship literature by developing and testing a framework that integrates self-discrepancy theory with social identity theory for a nuanced understanding of academic scientists' thought processes regarding engagement in entrepreneurial activities. Our study has implications for research policy by suggesting a way that universities can identify candidates for academic entrepreneurship activities.

**Keywords** Academic entrepreneurship · Self-discrepancy theory · Self-guide · Other-guide · Social identity

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# 1 Introduction

Enthusiasm is the mother of effort, and without it nothing great was ever achieved. ~Ralph Waldo Emerson

To commercialize university-based inventions and discoveries, legislators and administrators have called on academic scientists to expand their conventional research, grant writing, and teaching foci, to add entrepreneurial activities (Perkmann et al., 2013, 2021). Yet, few academic scientists seem enthusiastic to become entrepreneurs. As Ralph Waldo Emerson suggests, enthusiasm is a powerful motivator that amplifies an individual's efforts toward an activity (Glassman & McAfee, 1990). Academic entrepreneurship research has yet to address the function of entrepreneurial enthusiasm in predicting future entrepreneurial behavior. We define entrepreneurial enthusiasm as the positive affect felt when considering entrepreneurial tasks—i.e., a strong feeling of pleasure and interest in becoming involved in entrepreneurial activities. It is an “emotional manifestation of passion” (Jiang et al., 2022) and mounting evidence suggest that positive affective states, similar to enthusiasm, are crucial for academic entrepreneurial behavior, such as filing patents, and creating spinoffs (Huyghe et al., 2016; Obschonka et al., 2019). Enthusiasm is noted to be specifically important in contexts that call for creativity (Williamson et al., 2019), perseverance (Cardon & Kirk, 2015; Drnovsek et al., 2016), goal realization (Laguna et al., 2016) and attracting funders (Jiang et al., 2022), and other efforts required to transfer technology.

Yet, entrepreneurial enthusiasm has been an overlooked link between academic entrepreneurs' impassioned feelings to act entrepreneurially and their self-identity and beliefs about entrepreneurship. According to research, academic scientists who engage in academic entrepreneurship (henceforth AE), such as patenting, licensing, start-up creation and other commercialization activities (Grimaldi et al., 2011; Perkmann et al., 2013), must identify as both scientists and entrepreneurs (Huyghe et al., 2016; Jain et al., 2009; Meek & Wood, 2016). Positive affective states like enthusiasm are intricately tied to the identity of entrepreneurs and entrepreneurial tasks necessary for AE (Cardon & Kirk, 2015; Drnovsek et al., 2016; Obschonka et al., 2012). While existing research has improved our understanding of academic entrepreneurs and their identities (Guo et al., 2019a, 2019b; Zou et al., 2019a), the literature remains deficient in several ways.

First, few studies have explored the relationship between enthusiasm, identity, and entrepreneurial activities (Adam & Fayolle, 2015; Kautonen et al., 2013; Van Gelderen et al., 2015; Zhao & Liu, 2022). Among those that have explored this relationship to our knowledge, none have assessed how different and seldom investigated forms of identity correspond enthusiasm. For example, identity research in AE has mostly elucidated one form of identity called the current identity, defined as currently held self-beliefs about how individuals see themselves (i.e., an identity tied to the present), yet there are two additional types of future-oriented identity beliefs—an ideal identity and an “ought” or other identity—that are expected to guide future behavior (Ashforth & Mael, 1989; Higgins, 1987; Huber et al., 2018). These future-oriented identities may be linked to entrepreneurial tasks and other positive affective states (Farmer et al., 2011). Second, past entrepreneurship research that has explored enthusiasm has stressed its consequences, ignoring meaningful antecedents. This omission impedes understanding of how enthusiasm for academic entrepreneurial behavior can be developed.

In this paper, we explore identity's association with enthusiasm through the lens of self-discrepancy theory (Higgins, 1987). This theory involves the *self-guide*, which addresses the question, “Who do I *want* to be?” while the other-guide focuses on the question,

“Who *should* I be based on my internalized sense of obligation?” The self-guide is aspirational and has been conceptualized as a desired identity while the *other-guide* is obligatory because it focuses on internalization of others’ expectations. These identities focus on future possible identities and thus are expected to guide and predict future behavior (Karniol & Ross, 1996; Martinez et al., 2021) and associate with positive affective states. However, unlike other identity theories which focus on current identity beliefs (e.g., role identity theory, social identity theory), self-discrepancy theory states that two discrepancies—one between one’s self-concept and self-guide and the other between one’s self-concept and other-guide—induce negative emotions. To reduce the negative emotions associated with large self-discrepancies, individuals require enthusiasm to align their self-concept with future desires and expectations. Therefore, when either self- or other-guides create large self-discrepancies with the self-concept, it will likely impact an academic scientist’s enthusiasm to engage in AE.

Our paper addresses two fundamental questions. First, how might discrepancies between current and future-identity beliefs (i.e., who I am today versus who I want to be in the future) affect scientists’ enthusiasm for AE? Second, how might current identification with an academic entrepreneur or a scientist identity moderate the effects of such discrepancies on enthusiasm for AE? To answer the first research question, we use two future-oriented identity beliefs—the self-guide and the other guide. To address the second question, we combine social identity theory and self-discrepancy theory to hypothesize the moderating effects of identification with scientific and academic entrepreneur identities on the link between identity discrepancies and entrepreneurial enthusiasm. We predict that social group identification interacts with the self-discrepancy between current identity and self-guide to alter entrepreneurial enthusiasm, as posited by social identity theory. We test a model that predicts AE enthusiasm using a sample of U.S. National Science Foundation (NSF) Innovation Corps (I-Corps™) funded academic scientists who participated in the NSF I-Corps program. This seven-week program trains and equips scientists to expand their research beyond the academic laboratory and progress towards commercialization of research to enhance the economic and societal impact of NSF funded projects.

Our work contributes to the academic entrepreneurship literature in three ways. First, this study investigates key intrinsic factors that affect a faculty member’s entrepreneurial enthusiasm. Entrepreneurial enthusiasm is an important but under-researched construct that merits more exploration, as it both initiates and sustains action despite setbacks. This aspect is particularly relevant in universities, where faculty members can choose whether to engage in entrepreneurial activity (Siegel & Wright, 2015). Second, we examine how two future-oriented identity beliefs—ideal and ought selves—provide self- and other-guides, respectively, that influence enthusiasm for AE. Finally, we also integrate social identity and self-discrepancy theory to show the interaction effect of current social group identification and self-discrepancy on entrepreneurial enthusiasm. Thus, we advance the AE literature by analyzing the interaction of self-discrepancy and social identity theories that propel academic entrepreneurship.

## 2 Academic entrepreneurship, enthusiasm, and self-discrepancy theory

While AE is important to university, society, and students (Abreu & Grinevich, 2013), few universities achieve the degree of AE engagement that they desire from their scientists. Extrinsic factors such as time, money, and other rewards have been proposed as factors of this lack of engagement (Ramos-Vielba et al., 2016; Tartari & Breschi, 2012; Tartari et al., 2012). However, such research has only explained a small portion of the variance in academic scientists' AE propensity. Intrinsic factors also predict entrepreneurial behavior (Baron, 2008; Cardon et al., 2009). Such factors are especially germane to the AE context because academic scientists have significant discretion over whether to engage in AE. Thus, to understand why some engage more enthusiastically than others, we must consider intrinsic factors (Balven et al., 2018; Hmieleski & Powell, 2018; Meek & Wood, 2016; Neves & Brito, 2020).

We contend that entrepreneurial enthusiasm is key to understanding AE engagement as enthusiasm leads to greater engagement (Salanova et al., 2011). A scientist's entrepreneurial enthusiasm is important because it inspires goal pursuit, zest for the work, and motivates engagement with perseverance (Beck et al., 2017). At the neurological level, enthusiasm increases autonomous nervous-system activity, heightening engagement and involvement with the target of that enthusiasm (Burke et al., 1989). Since AE is often an arduous journey beset with obstacles, a lack of enthusiasm may lead to the abandonment of even the strongest entrepreneurial intentions (Adam & Fayolle, 2015; Van Gelderen et al., 2015). In sum, enthusiasm is necessary to overcome challenges that might derail intention (Busenitz & Barney, 1997).

Applications of identity theory have provided some of the most promising advancements in addressing why some academic scientists engage in AE activities and others do not. Previous research has proposed that AE requires adopting and managing dual identities of scientist and entrepreneur (Jain et al., 2009; Meek & Wood, 2016) and suggests that conflicting identities might affect AE performance (Guo et al., 2019a, 2019b; Zou et al., 2019a, 2019b). While such research has provided important insights, more study is required to understand how identity and identification corresponds with entrepreneurial enthusiasm. Future-oriented identity beliefs (e.g., desired [ideal] or expected [ought] identities) may influence academic entrepreneurship enthusiasm, and current social identification with AE or scientist groups may influence future-oriented identities.

Analyzing future-oriented identity beliefs enhances the understanding of why some academic scientists are enthusiastic about AE and others are not. Higgins (1987) self-discrepancy theory is helpful in this regard. Applying this theory to the AE context, the scientist's *self-concept* (also called the actual or current self) is a representation of who academic scientists believes themselves to be in the present. The *self-guide* (also called the ideal self), an important guide for future action, is the scientist's perception of who she aspires to be. For example, an individual may think of herself as a scientist today, but may aspire to be an academic entrepreneur later in her career. The *other-guide* (also called the ought self) represents the scientist's internalized beliefs about what kind of person she feels obligated to be based on expectations from others she respects and desires to please. For example, a scientist who wants to please her department chair might identify today primarily as a scientist. However, if her department chair encourages academic entrepreneurship, she might feel obligated to adopt an academic entrepreneur identity to guide her future behavior.

Self-guide relates to the scientist’s desires, aspirations, and hopes while the other-guide is based on others’ expectations, leading to a sense of obligation, duty, and responsibility. Discrepancies between the self-guide and the self-concept or the other-guide and the self-concept result in unpleasant negative emotions that motivate the individual to resolve the discrepancy. In contrast, contemplating activities that bring the individual closer to these guides evokes positive emotions such as enthusiasm (Barnett et al., 2017). Thus, wider discrepancies can act as a motivational force and would be expected to increase enthusiasm for activities that bring the self-concept closer in line with these guides.

### 3 Expanding academic entrepreneurship identification theory

We next develop our research model of how two identity discrepancies associated with self-discrepancy theory correspond with entrepreneurial enthusiasm and how identification with scientist and entrepreneur identities—based on social identity theory—interacts with identity discrepancies. Figure 1 outlines our hypothesized research model.

#### 3.1 Self-discrepancy theory: self- and other-guides influence enthusiasm

We reason that academic scientists’ entrepreneurial enthusiasm is dependent on the discrepancy between current identity beliefs—the self-concept—and two future-oriented identities, the self-guide and the other-guide. Self-discrepancy theory (Higgins, 1987, 1989) posits that the discrepancy between an individual’s self-concept and self-guide causes an individual to experience negative psychological effects unless they find a way to change their self-concept through activities related to their self-guide (Flores & Day, 2006; Huber et al., 2018; Malär et al., 2011). This negative psychological effect is due to the inability to attain an ideal self, which leads to disappointment, dissatisfaction, and dejection. Similarly, a discrepancy between the self-concept and other-guide implies a gap between who individuals are and their internalized beliefs about who significant others expect them to be. This discrepancy renders them vulnerable to anxiety, agitation,

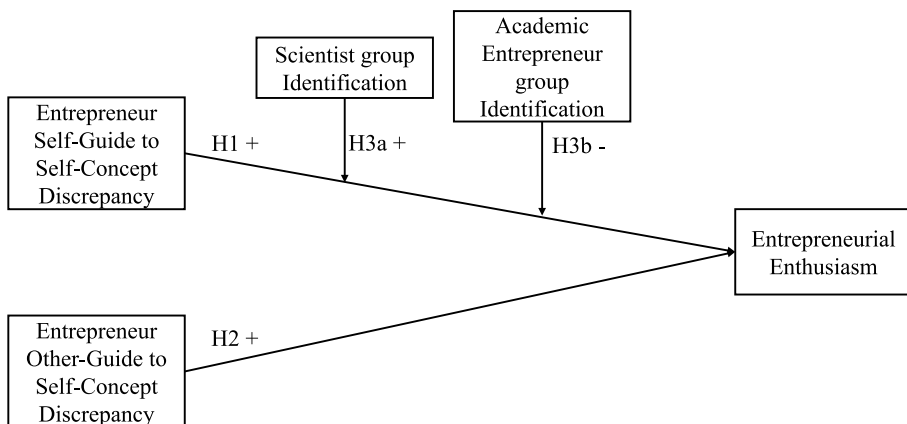


Fig. 1 The research model

and fear due to anticipated penalties associated with dereliction of one's duties, obligations, and responsibilities (Higgins et al., 1986, 1994).

Negative emotions associated with large discrepancies interrupt action and deter mobilization of cognitive resources (Fredrickson et al., 2003; Koole & Jostmann, 2004). Negative emotions provide feedback on goal attainment, signaling a need to change behavior and reprioritize goals (Carver & Scheier, 1996). When individuals anticipate negative emotions, they act to prevent their occurrence (Grant & Wrzesniewski, 2010; Nifadkar et al., 2012). By engaging in activities that align the self-concept with their future-oriented guides, individuals can resolve discrepancies by bringing their self-concept closer to their desired (or obligated) future.

Based on the self-discrepancy theory, we first posit that a wider self-guide to self-concept discrepancy—what we call *self-guide discrepancy*—arouses negative emotions. For example, a scientist who wishes to adopt an entrepreneurial identity but is unable to will likely experience a range of negative feelings such as fear, guilt, or self-contempt. Because these negative emotions are uncomfortable, they lead to goal reprioritization and motivate engagement in discrepancy-reduction behavior (Higgins, 1987). When the magnitude of the self-concept is lower than the self-guide, the individual experiences a positive self-guide discrepancy that encourages them to engage in new behavior associated with the self-guide. That is, academic scientists experience enthusiasm to engage in activities that allow them to align who they are (self-concept) with who they desire to be (self-guide). When the self-guide is more aligned with an entrepreneur identity than the self-concept, the academic scientist is motivated to act according to the entrepreneur self-guide to reduce the gap between current and desired behavior. Reducing this gap allows the scientist to experience positive emotions and avoid negative ones. Thus, when the positive self-guide discrepancy is high, one is expected to be more enthusiastic about engaging in entrepreneurial activities.

**Hypothesis 1** A positive self-guide discrepancy is positively associated with entrepreneurial enthusiasm.

Self-discrepancy theory suggests that an academic scientist's other-guide also influences entrepreneurial enthusiasm. Individuals seek out and listen to the views of others they respect and try to live up to their expectations. When those beliefs are internalized, they become the other-guide, or the standard for obligations and duties, which helps them answer the question, "What *should* I do?" An academic facing the decision to engage in AE must not only consider that their longstanding daily tasks may significantly change in this new role (Jain et al., 2009), but they must also engage in identity work, or the process of revising an identity, to decide if engaging in new activities associated with the new role will enhance or detract from how others view them (Azagra-Caro et al., 2006; Fini et al., 2018).

As part of the work associated with incorporating a new identity into their self-identity, professionals also consider the feelings and expectations they believe others in their profession hold about the new role (Farmer et al., 2003). For example, even if the focal scientist disagrees, she may assume that respected scientists believe that a scientist identity is more (or less) valuable than an entrepreneur identity, pushing her to consider the beliefs she imagines others hold in assessing opportunities (Ashforth & Kreiner, 1999; Glynn, 2000; Goffman, 2009; Pratt & Foreman, 2000).

Similar to the effect of a positive self-guide discrepancy, we consider a higher other-guide than the self-concept to create a positive other-guide discrepancy. Thus, based on self-discrepancy theory, we reason that when there is a positive other-guide discrepancy—that is, when the other-guide is more supportive of entrepreneurial activities than the self-concept—we expect scientists will be more enthusiastic about taking on entrepreneurial tasks. When scientists internalize the belief that important others think they should engage in more entrepreneurial activities than they currently do, they seek to reduce the gap to experience positive and avoid negative emotions. Thus, we propose:

**Hypothesis 2** A positive other-guide discrepancy is positively associated with entrepreneurial enthusiasm.

### 3.2 Integrating social identity theory with self-discrepancy theory

So far, we have linked positive self-guide and other-guide discrepancies to entrepreneurial enthusiasm. In doing so, we have theorized that these discrepancies involve comparisons between an individual's self-concept and self-guide or other-guide without fully considering that social identification with a particular group can exacerbate or attenuate these discrepancies because social groups can be an important contributor to an individual's self-concept (Mmbaga et al., 2020; Tajfel et al., 1979). Social identity theory suggests that identification is the perceived belongingness to a social group, which implies sharing congruent goals, motivations, and values with other group members (Stets & Burke, 2000; Tajfel et al., 1979).

Individuals can experience the psychological effects of identifying with a social group that supports their current self-concept, but whose values conflict with their self-guide. Because identification with a social group influences action and emotion, individuals respond to group failures and beliefs as their own, thus affecting their emotional experiences (Hirt et al., 1992) and exacerbating self-discrepancies (Gao et al., 2021). Furthermore, individuals may perceive that their current identification with a once-valued social group is impeding their actions toward achieving their desired future identity if they believe the values are in conflict. The conflict between values of a social group that is important to an individual's current identity and the values of future-oriented guides can lead to negative views of self-concept, group, or both (Charles et al., 2009). Rather than strengthening the individual's enthusiasm for their currently identified groups, such effects can exacerbate the effect of self-discrepancies—that is, it may make the individual more enthusiastic about engaging in activities that align with the desired future identity represented by the self-guide (Burke, 2020). For academic scientists, the degree of scientist identification may thus increase the positive relationship between a positive self-guide discrepancy and entrepreneurial enthusiasm. In other words, at higher levels of current scientist identification, entrepreneurial enthusiasm increases as the gap between entrepreneurial self-concept and positive self-guide widens.

Conversely, academic scientists with a high level of current social identification with the academic entrepreneur group have already adopted the AE identity and therefore see themselves as conforming to AE group norms, behavior, and attitudes (Ambos et al., 2008). Furthermore, academic entrepreneurial activities provide positive feelings when actions align with the beliefs and values of the social group with whom they identify. For such individuals, a positive self-guide discrepancy may have marginal effect on their enthusiasm for entrepreneurial activities, as they already identify as academic entrepreneurs and

believe themselves to be easily capable of future entrepreneurial activities. Therefore, a positive self-guide discrepancy might not impact their enthusiasm to engage in academic entrepreneurship at higher levels of current AE identification as much as it might for lower current levels. Based on this theorizing, we hypothesize the interaction effects as follows:

**Hypothesis 3a** Current identification with the scientist group identity intensifies the effect of positive self-guide discrepancy on entrepreneurial enthusiasm such that the effect is increased for individuals with higher current scientist identification.

**Hypothesis 3b** Current identification with the academic entrepreneur group identity dampens the effect of positive self-guide discrepancy on entrepreneurial enthusiasm such that the effect is attenuated for individuals with higher current academic entrepreneur identification.

## 4 Methods

### 4.1 Research setting

We drew our sample from academic scientists funded by the National Science Foundation Innovation Corps Grant program (NSF I-Corps), an entrepreneurship training program for NSF-funded academic scientists. The respondents had shown some interest in academic entrepreneurship through participating in I-Corps training, but their engagement in subsequent entrepreneurial activities varied and thus provided an ideal sample.

The university-based scientists were Principal Investigators (PI) and Co-PI's on research-based NSF grants within the five years before receiving the I-Corps grants. Thus, we expected them to have identified at some point with the traditional scientist identity. Further, we expected them to have considered whether to continue engaging in entrepreneurial activities after completing the training program. To ensure we were exploring identity issues related to the academic entrepreneur role in current jobs, our sample consists only of those who stayed at their university after completion of the program.

### 4.2 Data and sample

Via email, we surveyed a random sample of 2061 NSF-funded academic scientists drawn from regionally stratified subgroups of the population. We received 246 responses resulting in a response rate of 11.94%. Of these, 164 completed the survey and consented to the use of their data in this study. Our sample consisted of 69% men and 31% women. The majority were Caucasian (66%) and married (84%). Commensurate with the population of STEM faculty in U.S. universities, respondents from under-represented ethnicities (African American, Hispanic, Native Indians, Multiracial) were less than 5% each, while 7% of respondents provided no response. In terms of rank, the sample included 16% chair or endowed professors, 33% full professors, 14% associate professors, 13% assistant professors on research tracks, 5% administrators and 6% post-docs, assistant professors (non-research), and research engineers. The top three scientific disciplines were life sciences (20%), physical sciences (40%), and social sciences (6%). The majority (43%) identified their research as both applied and basic, while 31% reported applied, 13% basic or somewhat basic, and 2% identified neither basic nor applied.



## 5 Measures

### 5.1 Entrepreneurial enthusiasm

In line with work by organizational and psychology scholars, we conceptualized enthusiasm as a specific type of positive affect associated with future involvement in the target activity (George, 2000; Heath & Jourden, 1997). We measured entrepreneurial enthusiasm using the response to a direct assessment question, “Would you consider yourself enthusiastic about the idea of academic entrepreneurship?” Our single-item measure is similar to single-item scales that have been deemed reliable and valid for survey research (Curhan et al., 2009; Wanous et al., 1997). The average rating for entrepreneurial enthusiasm on a five-point scale (5 = Definitely Yes) was 4.0 (SD = 1.16).

### 5.2 Self-concept, self-guide, and other-guide

Self-discrepancies have been measured in many ways (Barnett & Womack, 2015; Barnett et al., 2017; Hardin & Lakin, 2009; Watson et al., 2016). Although the specifics of these measures vary, they all operationalize the magnitude of discrepancy between current and future-oriented identities (also known as guides). We adapt this approach to the self-discrepancy measurement in this study by creating two self-discrepancy measures, one for the self-guide to self-concept discrepancy and another for the other-guide to self-concept discrepancy. To construct these variables, we measured *self-concept*, *self-guide*, and *other-guide* identity profiles using three constant sum score questions. Specifically, to measure *self-concept*, respondents were asked “Considering your current self—the person you are today—how much do the following contribute to your overall identity today? All elements must sum to total 100.” The self-concept, self-guide, and other-guide consisted of six different identity profiles: scientist, entrepreneur, faculty member of my university, teacher, family/social member, and unique individual. We then asked respondents to rate themselves based on these identity profiles using a sliding scale that must sum to maximum value of 100. For example, a respondent could rate herself as 50% entrepreneur, 20% scientist, and 30% family/social member and 0% on the others. We used similar procedures to measure the *self-guide* and *other-guide*. This approach allowed us identify and measure different identity profiles that respondents considered important or they perceived gave them value. These multiple identity profile measures elicited respondents’ opinions about the composition of self-concept, self-guide, and other-guide identities related to scientist and entrepreneur without producing mirror-image responses.

#### 5.2.1 Self-guide to self-concept discrepancy

Following work on self-concept to self-guide discrepancy, we calculated the magnitude of discrepancy between self-guide and self-concept as the difference between the respondents’ responses for self-guide and self-concept based on the same identity profile category (Phillips & Silvia, 2005). For example, to capture the entrepreneur self-guide to self-concept discrepancy, we subtract a respondent’s rating of their current entrepreneur identity from their ideal entrepreneur identity. A higher delta indicates a larger discrepancy, while a lower delta reflects a smaller discrepancy. The average self-guide to

self-concept discrepancy for entrepreneur identity is 5.90 ( $SD = 11.25$ ), suggesting our sample desired more entrepreneur identity than currently held.

### 5.2.2 Other-guide to self-concept discrepancy

The measure for discrepancy between the other-guide and self-concept was calculated similarly. The difference between the respondents' responses to the other-guide and self-concept questions provides a measure of how much the individual believes they should adopt the identity compared to their currently held self-identity. The mean discrepancy between other-guide and self-concept for entrepreneur identity is 1.61 ( $SD = 11.91$ ), meaning that they believe others want them to identify slightly more with being an entrepreneur than they currently do.

### 5.3 Current scientist group identification

We measured identification with a scientist identity using Settles (2004) identity centrality scale. Confirmatory factor analysis (CFA) resulted in a 4-item scale with a Cronbach alpha of 0.78.

### 5.4 Current academic entrepreneur group identification

We measured identification with a specific entrepreneurial identity that is relevant in this context, an academic entrepreneur identity, using Settles (2004) identity centrality scale. It included 7 items that loaded significantly onto one factor, with a Cronbach alpha of 0.92.

### 5.5 Control variables

We controlled for several additional factors that have been found to predict intentions to engage in AE that we thought might also influence entrepreneurial enthusiasm (Perkmann et al., 2013, 2021). To control for the effects of research area, we coded *research area* as 1 if the respondent's research area was life sciences or physical sciences and coded 0 for all others. We coded "*rank*" as 1 if the respondent held a tenured rank of chair/endowed professor, professor, associate professor, or administrator. The non-tenured positions were coded 0. To control for the respondent's confidence that they could succeed at entrepreneurial activities, we measured *self-efficacy* with a five-item, five-point Likert-type scale, where one equals strongly disagree, and five equals strongly agree. We adapted Holt et al. (2007) six-item scale to create our five-item scale retaining the items most applicable to our context. The 5 items loaded onto a single factor with a Cronbach alpha of 0.73.

We also controlled for the effect of goals that the respondents perceived AE could fulfill. We created a "*reason for AE engagement*" scale based on D'Este and Perkmann (2011). Specifically, with this measure we assessed the academic's reasons to engage in academic entrepreneurship including pecuniary benefits such as additional income and research grants, and non-pecuniary benefits such as networking for student placements and inspiration for research projects. Our factor analysis confirmed the 8-item scale with high factor loadings and a Cronbach alpha of 0.85 as shown in Table 4. To measure a respondent's *prior engagement level* in AE, we adopted a scale measuring a variety of industry interaction by academics including patenting, invention disclosures, technology licensing, startup/spinoff creation, and consulting (D'Este & Patel, 2007). The final measure of 5 items has a

Cronbach's alpha of 0.92. We also controlled for *gender* and *research productivity*; the latter was measured by number of academic publications.

To ensure acceptable model fit, we used a confirmatory factor analysis (CFA) to establish discriminant and convergent validity of three latent variables, *scientist identity*, *academic entrepreneurial identity*, and *self-efficacy*. The goodness-of-fit statistics confirm each factor as separate latent constructs ( $\chi^2(101)=198.86$ , RMSEA=0.08, CFI=0.92, TLI=0.91, SRMR=0.06, AVE>0.5). Table 5 in Appendix 1 presents the goodness-of-fit indicators of models for our latent variables and Fig. 4 in Appendix 1 presents the factor structures of our model. The three-factor model fits better than other models and meets or exceeds Hu and Bentler's (1999) acceptable cutoff levels. Hence, we demonstrate that our latent variables have convergent and discriminant validity according to accepted practice (Cangur & Ercan, 2015; Hayduk & Glaser, 2000).

## 6 Analysis and results

Table 1 shows descriptive statistics and zero-order correlations. The OLS regression assumptions of error independence and heteroscedasticity are violated in our data. In the presence of heteroscedasticity, OLS can produce biased parameter estimates and misleading hypotheses tests. To resolve this issue, we used regression with "beta" and "robust" options in STATA 15. This algorithm calculates standardized coefficients, accounts for model heteroscedasticity, and accounts for influential observation points. STATA's robust regression is 95% as efficient as OLS regression (Hamilton, 1992). We did not find any issues with multicollinearity with all VIFs<2. Our results from the standardized robust regression using the beta and robust options with the regress command in STATA are shown in Table 2.

We first regressed the dependent variable *entrepreneurial enthusiasm* on the control variables in Model 1. As expected, self-efficacy ( $\beta=0.079$ ,  $p<0.001$ ), reason for AE engagement ( $\beta=0.034$ ,  $p<0.05$ ), and prior engagement ( $\beta=0.058$ ,  $p<0.001$ ) have statistically significant and positive correlation with entrepreneurial enthusiasm. The correlation between an individual's rank and entrepreneurial enthusiasm is negative and statistically significant ( $\beta= -0.418$ ,  $p<0.05$ ), suggesting those with tenure are less enthusiastic about AE than non-tenured scientists.

Model 2 summarizes the findings for the first two hypotheses, the effect of discrepancies between self-guide and self-concept, as well as other-guide and self-concept on entrepreneurial enthusiasm. The findings indicate an individual's self-guide to self-concept discrepancy has a statistically significant positive correlation with an individual's entrepreneurial enthusiasm ( $\beta=0.020$ ,  $p<0.01$ ), while the other-guide to self-concept discrepancy was not statistically significant. These findings provide support for Hypothesis 1, but not for Hypothesis 2.

Model 3 shows the results when adding the moderating variables as hypothesized in Hypothesis 3a (current identification with the scientist group increases the effect of the self-guide discrepancy) and 3b (current identification with the academic entrepreneur group decreases the effect of the positive self-guide discrepancy). As is standard practice, we added the main effects for scientist and academic entrepreneur group identification as well as the hypothesized interaction terms. As predicted by prior research, scientist group identification has a statistically significant and negative correlation with entrepreneurial enthusiasm ( $\beta=-0.063$ ,  $p<0.01$ ), while academic entrepreneur identification has a statistically significant and positive correlation with entrepreneurial enthusiasm ( $\beta=0.065$ ,  $p<0.001$ ) (Guo et al.,

**Table 1** Descriptive statistics and zero order correlations

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Entrepreneurial enthusiasm	4.00	1.16	1													
2. Self-efficacy	15.58	3.80	0.41*	1												
3. Reason for AE engagement	25.94	6.41	0.36*	0.21*	1											
4. Prior engagement level	10.96	6.61	0.47*	0.34*	0.29*	1										
5. Rank	0.68	0.47	-0.17	0.04	-0.13	0.09	1									
6. Research area	0.62	0.49	0.11	0.01	0.04	0.06	-0.10	1								
7. Gender	1.27	0.45	-0.16	-0.08	0.09	-0.26*	0.11	-0.07	1							
8. Research productivity	4.04	1.26	-0.04	-0.08	-0.02	0.12	0.21*	0.04	-0.15	1						
9. Current AE group identification	17.80	10.67	0.72*	0.43*	0.36*	0.53*	-0.18	0.14	-0.17	-0.03	1					
10. Current dentist group identification	12.17	4.23	-0.10	-0.17	0.07	0.08	0.10	0.27*	0.09	0.37*	0.07	1				
11. Entrepreneur self-guide to self-concept discrepancy	5.90	11.25	0.29*	0.05	0.17	0.12	-0.10	0.09	-0.14	0.12	0.30*	-0.05	-0.24*	1		
12. Entrepreneur other-guide to self-concept discrepancy	1.61	11.91	0.01	0.23*	-0.03	-0.05	-0.13	0.01	0.04	-0.05	-0.06	-0.07	-0.21*	0.28*	-0.25*	1

\*  $p < 0.05$  (2-tailed)

**Table 2** Regression results

Variables	Model1 b/se	Model2 b/se	Model3 b/se	Model4 b/se
<i>Control variables</i>				
Self-efficacy	0.079***	0.080***	0.037	0.043
Reason for AE engagement	0.034**	0.028*	0.014	0.014
Prior engagement level	0.058***	0.057***	0.015	0.013
Rank—non-tenured (base level)	0	0	0	0
Rank—tenured	-0.418**	-0.372*	-0.201	-0.18
Research area—others (base level)	0	0	0	0
Research area—life or physical sciences	0.15	0.122	0.126	0.097
Gender—female (base level)	0	0	0	0
Gender—male	-0.127	-0.07	0.015	-0.016
Research productivity	-0.026	-0.047	0.058	0.043
<i>Independent and Moderator Variables</i>				
Entrepreneur self-guide to self-concept discrepancy		0.020***		0.052**
Entrepreneur other-guide to self-concept discrepancy		0.001		0.001
Current scientist group identification			-0.063***	-0.041
Current AE group identification			0.065***	0.068***
Entrepreneur self-guide to self-concept discrepancy * current scientist group identification			0.003***	0.002**
Entrepreneur self-guide to self-concept discrepancy * current AE group identification			-0.001***	-0.003***
Constant	1.587**	1.667**	2.301***	1.918***
	-0.69	-0.72	-0.59	-0.66
Sample Size	110	110	110	110
R-squared	0.375	0.412	0.594	0.613
Degrees of Freedom	102	100	98	96
AIC	308	305	268	267
BIC	329	332	300	305

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ 

2019a, 2019b; Zou et al., 2019a, 2019b). Furthermore, the scientist group identification interaction term has a statistically significant and positive correlation with entrepreneurial enthusiasm ( $\beta = 0.003$ ,  $p < 0.01$ ), and the academic entrepreneur group identification interaction term has a statistically significant and negative correlation with entrepreneurial enthusiasm ( $\beta = -0.001$ ,  $p < 0.01$ ). These findings provide preliminary support for Hypothesis 3a and 3b.

The full model includes all the independent variables, interaction terms, and the control variables. As shown in Model 4 in Table 2, one of our hypothesized independent variables, self-guide to self-concept discrepancy, and two of its interactions (with scientist group identification and with academic entrepreneur group identification) have significant effects ( $\beta = 0.052$ ,  $p < 0.05$ ;  $\beta = 0.002$ ,  $p < 0.05$ ;  $\beta = -0.003$ ,  $p < 0.01$ ) on entrepreneurial enthusiasm. The interaction effects are shown in the predicted margins plots in Figs. 2, 3. This confirms support for Hypotheses 1, 3a, and 3b. We further find that the control variables self-efficacy, reason for AE engagement, prior engagement level, and rank that were significant in Model 1 lose significance in the full model.

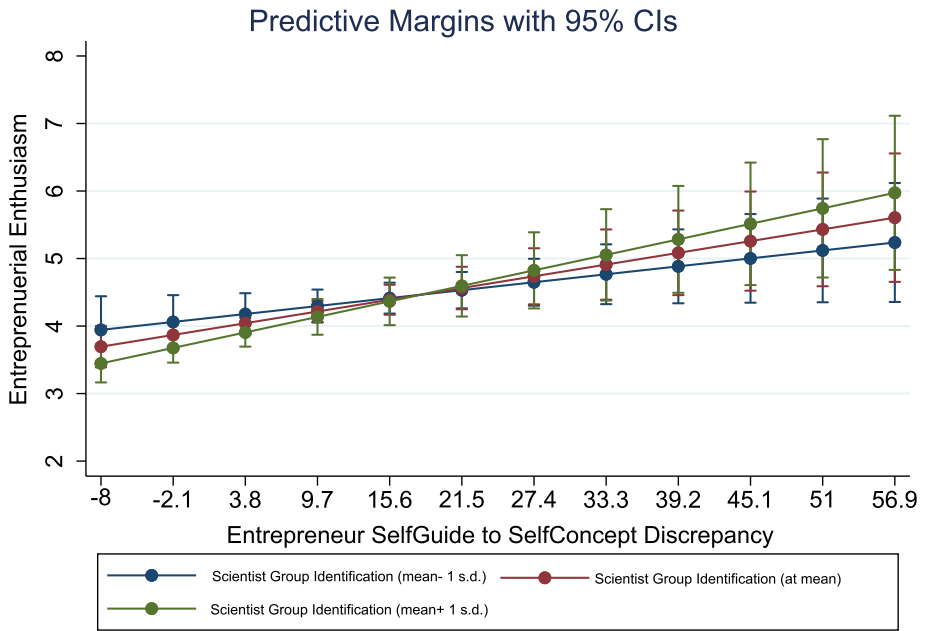


Fig. 2 Moderation effect of scientist group identification

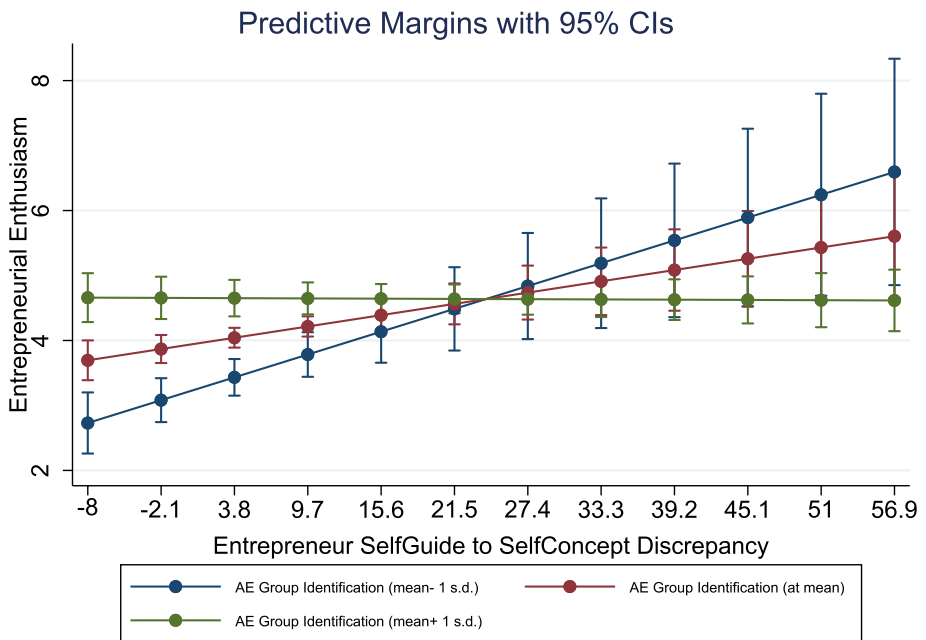


Fig. 3 Moderation effect of academic entrepreneur group identification

Following recommendations by Semadeni et al. (2014), we conducted a Durbin test and a Wu–Hausman post-estimation analysis to test for a potential endogenous covariate, academic entrepreneur social group identification. Entrepreneurial identity may be correlated with some unobservable characteristics in the error term relevant to our sample that encourages enthusiasm for AE (Bercovitz & Feldman, 2008). Thus, we conducted additional analyses using the Stata *ivregress* command with two instrumental variables, external support, and perception of AE as a career benefit. Our test for endogeneity using the Durbin Chi-Square test indicates entrepreneurial identity is exogenous ( $\chi^2=2.53$   $p>0.05$ ). This is also confirmed using the Wu-Hausman test ( $F(1,99)=2.35$ ,  $p>0.05$ ) implying that our regression model is appropriate (Hamilton & Nickerson, 2003).

Given that the dependent variable, entrepreneurial enthusiasm, is ordinal, we used an ordinal probit regression test to ensure the robustness of our findings. The results displayed in Table 3 demonstrate the reliability of our findings. We find evidence supporting Hypotheses 1, 3a, and 3b, but not Hypothesis 2.

## 7 Discussion

We used self-discrepancy theory to explore how future-oriented identity beliefs associate with entrepreneurial enthusiasm. Our first research question was: How might discrepancies between current and future identity beliefs impact AE enthusiasm? To answer this, we introduced two identity beliefs into the AE literature: self-guide and other-guide. We found that a positive self-guide discrepancy predicted AE enthusiasm while a positive other-guide discrepancy had no significant effect. We then integrated insights from social identity theory with self-discrepancy theory to answer the research question: How might current social identification with an academic entrepreneur or scientist identity moderate the effects of self-discrepancies on AE enthusiasm? Our results reveal that stronger academic entrepreneur identification attenuates the effect of self-guide discrepancy on entrepreneurial enthusiasm, whereas stronger scientist identification enhances the effect of the self-guide discrepancy on entrepreneurial enthusiasm. Overall, we find that the scientist's aspirational identity (the self-guide) is important in creating enthusiasm for entrepreneurial activities while their sense of obligations to others (the other-guide) was not.

### 7.1 Contributions

Our results suggest two key contributions. First, by directly measuring enthusiasm to engage in AE, we provide a nuanced understanding of an important mechanism affecting AE engagement. Entrepreneurial intention has been often used as a proxy for future engagement. However, the gap in intention-engagement link is significant (Adam & Fayolle, 2015). Directly measuring enthusiasm constitutes a contribution because without enthusiasm, intention is unlikely to become engagement (Busenitz & Barney, 1997). Enthusiasm inspires and motivates aspiring entrepreneurs to persevere through the obstacles inherent in the entrepreneurial process (Gisler et al., 2011). Our findings suggest that identity is a significant, yet complex, driver of entrepreneurial enthusiasm. This finding supports previous research suggesting identification is important for developing intentions prior to engagement (Krueger, 2007; Obschonka et al., 2012; Rise et al., 2010). We also extend this line of research to explain the role of identification in entrepreneurial enthusiasm prior to further engagement. Thus, our model may serve as a bridge between entrepreneurial intention and engagement. For these reasons, we believe future research should

**Table 3** Robustness check using ordered probit regression

VARIABLES	OProbitModel 1 b/se	OProbitModel 2 b/se	OProbitModel 3 b/se	OProbitModel 4 b/se
<i>Control variables</i>				
Self efficacy	0.106***	0.106***	0.065*	0.071*
Reason for AE engagement	0.042**	0.037*	0.025	0.023
Prior engagement level	0.072***	0.072***	0.02	0.021
Rank—non tenured (base level)	0	0	0	0
Rank—tenured	-0.334	-0.31	-0.082	-0.131
Research area—others (base level)	0	0	0	0
Research area—life or physical sciences	0.19	0.175	0.116	0.086
Gender—female (base level)	0	0	0	0
Gender—male	-0.194	-0.121	-0.106	-0.098
Research productivity	-0.07	-0.085	-0.022	-0.03
<i>Independent and moderator variables</i>				
Entrepreneur self-guide to self-concept discrepancy		0.035***		0.100*
Entrepreneur other-guide to self-concept discrepancy		-0.003		-0.004
Current scientist group identification			-0.083*	-0.067
Current AE group identification			0.126***	0.135***
Entrepreneur self-guide to self-concept discrepancy * current scientist group identification			0.007**	0.006**
Entrepreneur self-guide to self-concept discrepancy * current ae group identification			-0.002*	-0.005**
Sample	110	110	110	110
AIC	265	262	231	233
BIC	295	297	271	279

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$



focus on both the antecedents and consequences of entrepreneurial enthusiasm beyond identity and identification.

Additionally, enthusiasm has been studied in the general entrepreneurship literature as an aspect of entrepreneurial passion (Cardon et al., 2009; Murnieks et al., 2014; Newman et al., 2020). In that work, passion is conceptualized as a latent variable comprised of identification with entrepreneurship and enthusiasm for entrepreneurial activities. Given the complexity of academic identities, which include not only dual identities, but also temporal identity guides associated with self-discrepancy theory, studying the relationship between the enthusiasm and identity components of entrepreneurial passion might prompt important and nuanced findings to advance entrepreneurial passion research.

Second, this study adds to the body of research on dual, or hybrid, scientist-entrepreneur identities (Jain et al., 2009; Meek & Wood, 2016). We add to this line of research by extending the AE identity theory perspective and exploring how two additional identities—ideal and ought selves—provide self- and other-guides, respectively (Ashforth & Mael, 1989; Higgins, 1987; Huber et al., 2018). When academic scientists conclude that their current degree of identification with an entrepreneur identity is misaligned with their self-guide or other-guide, we expect them to be more enthusiastic about AE, as these beliefs provide important inspiration for desirable future behavior (Doby & Caplan, 1995; Lim & Sng, 2006). Thus, our findings regarding the self-guide discrepancy add support for one aspect of Higgins' self-discrepancy theory (1987). However, our findings about the function of the other-guide on entrepreneurial enthusiasm deviates from the prediction of self-discrepancy theory. We speculate that our findings exhibit this pattern because academic scientists may be more autonomous than other populations in which this aspect of self-discrepancy theory has held. That is, the internalization of others' wishes may not be as important for academic scientists as their own desires. Overall, we demonstrate the value of academic scientist's self- and other-guides in AE research. Thus, we propose an important and novel approach of examining the effects of identity in entrepreneurship that may help us better understand entrepreneurial outcomes.

We further add to the AE identity literature by examining how present social group identification influences future-oriented identity beliefs—i.e., self-guide and other-guide. In doing so, we show that such future-oriented identity beliefs do not operate in a vacuum. Current social group identification moderates its influence on entrepreneurial enthusiasm. This is an important finding as it extends prior theory on the role of identity in academic entrepreneurship. Our theory and findings suggest that both current social group identification and future-oriented identity beliefs must be analyzed together to better understand entrepreneurial enthusiasm for AE.

These findings could be useful for universities and other organizations looking to add entrepreneurial duties to scientists' work. Administrative, legislative, and other research policymakers can benefit from this research by better understanding identity and identification-based influencers of AE. Our findings may help leaders identify scientists more likely to engage in AE, allowing for more efficient human capital investment. In sum, universities must understand why academic scientists are enthusiastic (or not) about academic entrepreneurship in order to increase their participation and success. Our research contributes to clarifying why some academic scientists are enthusiastic about entrepreneurship while others are not.

## 7.2 Limitations and future research directions

We encourage further research on academic entrepreneurship both because it is an important domain in and of itself, but also because it provides an ideal context for investigating nuances found in various strands of identity research. Reduced funding and increased demand for relevant

research threaten academic scientists' sense of self, which makes identity concerns salient. Unlike many for-profit firms, university pressure to commercialize inventions is new, and organizational responses show important variance. Moreover, scientific disciplines have embraced AE at different levels, adding to the phenomenon's variability. Thus, while our findings are most directly applicable to academic scientists, they may be applicable to any situation in which individuals must negotiate their sense of self-identity within a changing landscape of professional identities. Research focused on academic entrepreneurship may also have important implications for corporate entrepreneurship. In both settings, the organization encourages its employees to be more entrepreneurial and create new business models (Hampel et al., 2020). We expect employees' self-discrepancies to influence the outcomes of such endeavors (Cooper & Artz, 1995).

Our study highlights the relationship between identity and entrepreneurial enthusiasm, which we believe is an important and understudied construct. We encourage future research to explore whether different magnitudes of identification affect other interesting, but less-proximal outcomes such as entrepreneurial performance. Longitudinal studies could explore whether the self-guide discrepancies we uncovered predict greater engagement and perseverance.

In contrast to qualitative studies with smaller and less-diverse samples, our design uses a survey to examine academic scientists across the U.S., which carries all of the standard concerns on survey research, including the concern that causation can never be definitely established. Our study is not without limitations. The number of available observations was limited and our response rate of 12% may not reflect an entirely representative sample, as this is a common occurrence and limitation of studies in the AE field. However, our response rate is in line with prior works in this area (see Abreu & Grinevich, 2017; Huyghe & Knockaert, 2015; Urban & Chantson, 2019) and power analyses indicated that the sample size was sufficient for testing the hypothesized relationships (Cohen, 1992).

Our model and findings are based on self-discrepancy and social identity theories, which gives us confidence that we have specified the correct causal order. We built our models on logic and included several control variables. In robustness checks, we tested other model parameters to rule out any spurious effects that could skew our results. Even with these steps to correct potential misattributions in our study, our findings should be interpreted with caution. For instance, we cannot rule out the possibility that entrepreneurial enthusiasm decreases identification with a scientist identity and increases identification with an entrepreneurial identity, or that entrepreneurial enthusiasm increases one's self-guide more than one's self concept or other-guide. These relationships are difficult to study in controlled laboratory settings, therefore, we encourage more longitudinal research.

We also discovered an unexpected pattern in our control variables that warrants further investigation. In Model 1, we found that self-efficacy, prior experience, academic scientists' reason for AE engagement, and rank were significant predictors of entrepreneurial enthusiasm, which is consistent with AE research. With the inclusion of identity-related variables in the regression models, these relationships lost statistical significance. This suggests that self-guide discrepancies and identification with social groups fully mediate the effects of self-efficacy, prior experience, and reason for engagement on entrepreneurial enthusiasm. To understand these intriguing but non-hypothesized relationships in our data, we encourage future research.

## Appendix

See Tables 4, 5, 6 and Fig. 4.

**Table 4** Exploratory factor analysis

Variables	Factor loadings
<i>Reason for AE engagement</i>	
1 Reason for AE access to resources, such as data, materials, or equipment	0.57
2 Ensuring research access or placement for students	0.63
3 Getting inspiration for research projects	0.62
4 Having intellectual property (e.g., patents) in my name	0.51
5 Increase odds of obtaining research grants	0.82
6 Learning odds of obtaining research grants	0.8
7 Obtain research income	0.77
8 Source of personal income	0.54
Cronbach Alpha	0.85
<i>Self-efficacy</i>	
1 There are some tasks that are required as an academic entrepreneur that I think I won't do well	0.51
2 I have the skills that are needed to be an academic entrepreneur	0.76
3 When I set my mind to it, I can learn everything that will be required to be an academic entrepreneur	0.56
4 Based on my knowledge skills and ability, becoming an academic entrepreneur would be easy for me	0.78
5 I am able to become an academic entrepreneur without the help of others	0.41
Cronbach Alpha	0.73
<i>Prior engagement level</i>	
1 Please indicate how much you have engaged in academic entrepreneurship? Select the total quantity of invention disclosures	0.89
2 Please indicate how much you have engaged in academic entrepreneurship? Select the total quantity of Patents	0.9
3 Please indicate how much you have engaged in academic entrepreneurship? Select the total quantity of technology license	0.86
4 Please indicate how much you have engaged in academic entrepreneurship? Select the total quantity of consulting	0.73
5 Please indicate how much you have engaged in academic entrepreneurship? Select the total quantity of StartUP/SpinOff creation	0.75
Cronbach Alpha	0.92
<i>Entrepreneur identity</i>	
1 Overall, being an academic entrepreneur has very little to do with how I feel about myself	- 0.82
2 In general, being an academic entrepreneur is an important part of my self-image	0.89
3 My destiny is tied to the destiny of other academic entrepreneurs	0.77
4 Being an academic entrepreneur is unimportant to my sense of what kind of person I am	0.63
5 I have a strong sense of belonging to the academic entrepreneurship community	0.91
6 I have a strong attachment to other academic entrepreneurs	0.88
7 Being an academic entrepreneur is an important reflection of who I am	0.94
Cronbach Alpha	0.92
<i>Scientist identity</i>	
1 I have a strong sense of belonging to the scientific community	0.86
2 I have a strong attachment to other scientists	0.83

**Table 4** (continued)

	Variables	Factor loadings
3	Being a scientist is an important reflection of who I am	0.62
4	Being a scientist is not a major factor in my social relationships	- 0.48
	Cronbach Alpha	0.78

**Table 5** Confirmatory factor analysis

Fit statistic	3 factor model	2 factor model	1 factor model	Description
<i>Likelihood ratio</i>				
df	101	103	104	
chi2_ms	198.855	422.185	528.158	Model vs. saturated
p > chi2	0	0	0	
chi2_bs(120)	1395.587	1395.587	1395.587	Baseline vs. saturated
p > chi2	0	0	0	
Chi2 /df	1.969	4.099	5.078	
<i>Population error</i>				
RMSEA	0.084	0.15	0.173	Root-mean squared error of approximation
90% CI, lower bound	0.067	0.136	0.158	
upper bound	0.101	0.165	0.187	
pclose	0.001	0	0	Probability RMSEA < =0.05
<i>Information criteria</i>				
AIC	6896.934	7116.265	7220.238	Akaike's information criterion
BIC	7045.853	7259.344	7360.397	Bayesian information criterion
<i>Baseline comparison</i>				
CFI	0.923	0.75	0.667	Comparative Fit Index
TLI	0.909	0.708	0.616	Tucker-Lewis Index
<i>Size of residuals</i>				
SRMR	0.063	0.126	0.142	Standardized root-mean squared residual
CD	0.999	0.99	0.958	Coefficient of determination

**Table 6** Average variance extracted

Average variance extracted			
	Factor 1	Factor 2	Factor 3
	0.76	0.92	0.44
	0.91	0.86	0.83
	0.69	0.7	0.58
	0.52	0.36	0.82
	0.9		0.3
	0.85		
	0.94		
	AVE		
	0.65	0.55	0.40
	Square Root AVE		
	0.81	0.74	0.63

\*All square root of AVE is greater than the individual factor correlations indicating discriminant validity

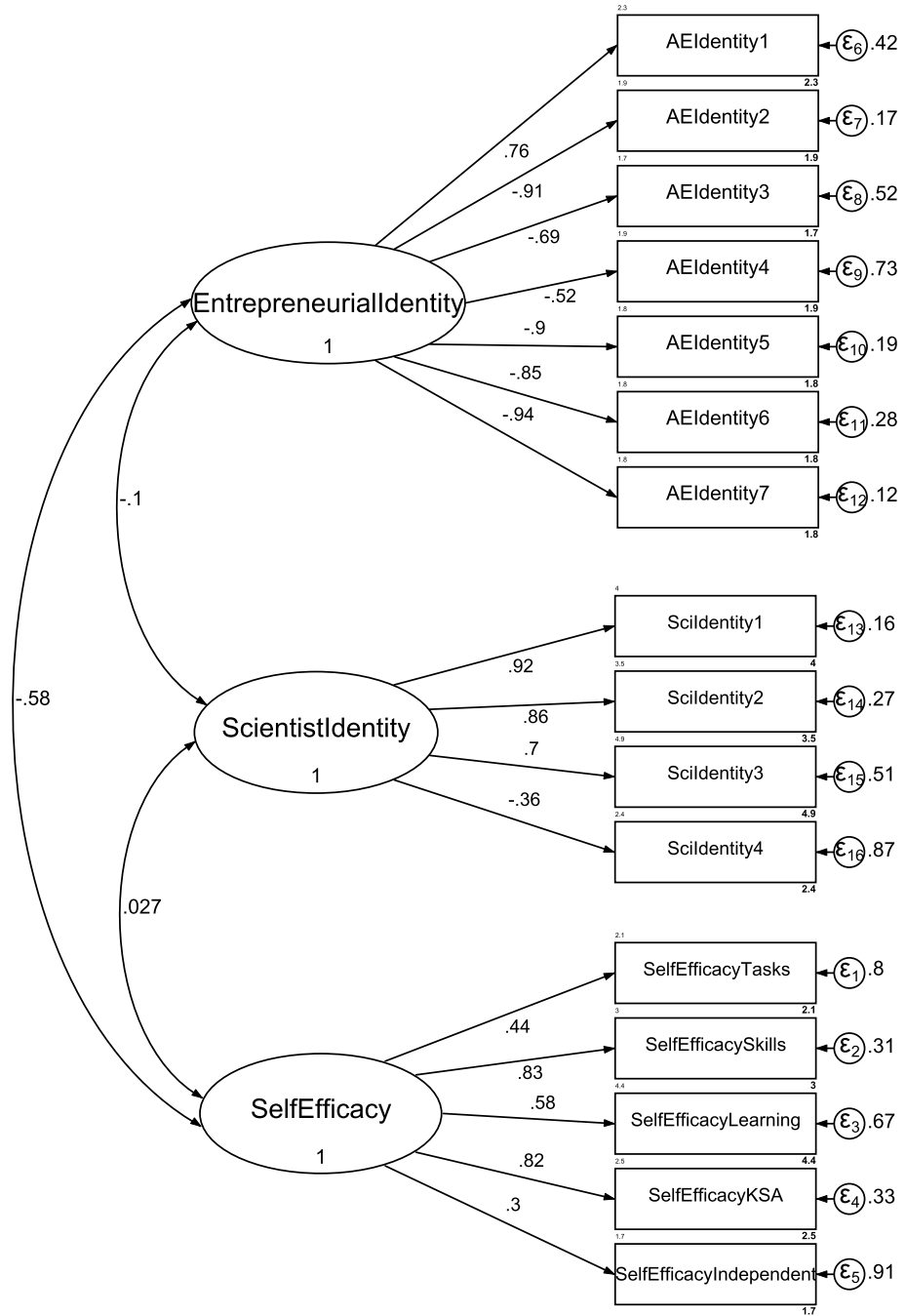


Fig. 4 Moderation effect of academic entrepreneur group identification

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**Data availability** The datasets generated during and/or analyzed during the current study are available in the Open Science Foundation repository, <https://osf.io/7cgv2/>

## Declarations

**Competing interests** The authors have no competing interests to declare that are relevant to the content of this article.

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