Exploring the Link Between Metacognitive Awareness and the Adoption of a Green Entrepreneurial Intention

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Abstract

The attention of the public has massively shifted towards sustainability in recent years, particularly regarding businesses and their role in climate change. Therefore, many view entrepreneurship as an opportunity to improve sustainability and address environmental issues. Previous research mainly focused on the variables that precede entrepreneurial intention. However, there are not many studies examining the variables affecting green entrepreneurial intention. Therefore, this study aims to investigate potential variables that influence green entrepreneurship. More specifically, previous studies showed that green entrepreneurship requires strategic decision-making, problem-solving skills, and self-regulation, which could all be linked to metacognitive awareness. Accordingly, this study attempts to investigate whether there is a relationship between metacognitive awareness skills and green entrepreneurial intentions. It also aims to identify which subcomponents of metacognitive awareness are most associated with sustainable entrepreneurial intentions. The target group of this study are university students, since previous research showed that the educational settings strongly influence entrepreneurial intentions. The goal of this study is to explore potential skills that could be fostered in educational settings to increase sustainable entrepreneurial intentions.

This study was conducted using a cross-sectional survey design consisting of 47 university students as participants. The data was collected using an online questionnaire, investigating the participants' demographics, metacognitive awareness levels and their green entrepreneurial intentions (GEI).

The correlation analysis revealed that there is a significant positive relationship between metacognitive awareness and GEI. The metacognitive awareness subcomponents, conditional knowledge and debugging strategies showed the strongest bivariate relation with GEI; however, a multiple regression analysis did not show any unique predictors.

Introduction

In recent years, society has become increasingly aware of climate change, its consequences, and the significance of sustainability. Simultaneously, the growing awareness is also evident in the economic sector, where businesses are recognised as the main drivers of detrimental environmental degradation through extensive waste pollution production and resource consumption (Hall et al., 2010; Uvarova et al., 2021). Overall, there is an increasing general understanding that the consumption of natural resources and energy production must be transformed to confront urgent environmental issues effectively (Hall et al., 2010). Prompted by these insights, many view entrepreneurship as a driving force for sustainable development and a means to address environmental challenges (Pacheco et al., 2009). Sustainable development describes a balance between environmental, economic, and social objectives (Hall et al., 2010).

Within this context, the term “green entrepreneurship” was coined, which essentially describes a distinct form of entrepreneurship with sustainability as its main business principle (Pacheco et al., 2009). While ensuring economic growth, green entrepreneurs also prioritise economic and social benefits, distinguishing them from traditional businesses that primarily focus on profit maximisation (Pacheco et al., 2009). Beyond the innovative role of entrepreneurship, it also significantly impacts employment growth and strengthens economic dynamics (Rusu & Roman, 2017). However, economic competitiveness progressively depends on the education of society, highlighting the significant role of universities in fostering entrepreneurial thinking and the development of new businesses (Bonaccorsi et al., 2013; Brigmane, 2019). Therefore, educational institutions are essential for developing future entrepreneurs since they play a crucial part in cultivating sustainability awareness, business knowledge, and entrepreneurial skills. Studies argued that promoting green entrepreneurial intentions and pro-environmental behaviour in entrepreneurial education is a key element to

equip students for the challenges of a transitioning economy (Tadena & Salic-Hairulla, 2021). According to Uvarova et al. (2021), the *green entrepreneurial intention* can be described as a combination of competencies, attitudes, and behaviours enabling entrepreneurs to incorporate environmental awareness, sustainability, and resource efficiency in potential future business practices. These processes comprise proactive problem-solving, strategic decision-making, creativity, as well as maintaining a balance between environmental, social, and economic interests (Uvarova et al., 2021).

Simultaneously, businesses are expected to be confronted with growing threats associated with climate change and environmental challenges in the future, forcing entrepreneurs to adapt their approaches, decision-making processes and values accordingly (Audretsch et al., 2018; Uvarova et al., 2021). To effectively approach environmental and sustainability challenges, entrepreneurs need the ability to make informed and adaptive decisions by going beyond environmental awareness (Uvarova et al., 2021). Considering the intricacy of these challenges, metacognitive beliefs seem to be essential to successfully navigating a sustainability-focused business.

Metacognition refers to the process of actively thinking about one's cognition (Flavell, 1979). It is divided into two separate components: metacognitive knowledge, which is also described as knowledge of cognition, and metacognitive regulation, also called regulation of cognition (Veenman, 2015). More specifically, knowledge about cognition encompasses three elements, such as declarative, procedural and conditional knowledge, which are essential for a reflective process (Schraw & Dennison, 1994). The second element, the regulation of cognition, involves the subprocesses planning, information management skills, monitoring and evaluation, which contribute to self-regulation (Schraw & Dennison, 1994). Metacognitive awareness particularly describes an individual's ability to understand their cognitive processes and control their learning by monitoring, regulating and adapting

their cognitive strategies, which plays an essential role in decision-making and problem-solving (Flavell, 1979; Çini et al., 2020). Previous studies have concluded that individuals with strong metacognitive awareness tend to be more successful in problem-solving and use their self-regulation strategies to adapt to external conditions and achieve personal goals (Çini et al., 2020; Zepeda & Nokes-Malach, 2023).

Considering that green entrepreneurship requires the navigation of multifaceted sustainability-oriented challenges, the adoption of green entrepreneurial intention might be affected by an individual's capability to regulate and evaluate their metacognitive processes. Previous studies have investigated potential influences on entrepreneurial intentions. The study by Feldman and Bolino (2000) suggested that an individual's entrepreneurial aspirations are determined by the potential economic impact and the individual's perception of the value of outcomes. Other studies also argued that entrepreneurial intentions are driven by a desire for independence and autonomy (Katz, 1995). More recent studies stated that family background, entrepreneurship education, self-efficacy and need for achievement have a strong correlation to an individual's entrepreneurial intentions (Salhi & Jemmali, 2018; Shrivastava & Acharya, 2020). While existing studies have examined various factors influencing entrepreneurial intention, the role of metacognitive awareness remains unexplored, particularly in the context of green entrepreneurship. Therefore, this study aims to explore the relationship between the adoption of green entrepreneurial intention and metacognitive awareness among students. In particular, it seeks to identify which specific elements of metacognitive awareness are most influential in developing green entrepreneurial intention.

Green Entrepreneurship

Green Entrepreneurship is closely associated with the concept of "sustainable development", which was first defined by the Brundtland Report as "development that meets

present needs without compromising the ability of future generations to meet their own needs" (World Commission On Environment And Development, 1987, p.15). The balance between environmental, economic and social objectives, which is the aim of sustainable development, is often referred to as the "triple bottom line" (Hall et al., 2010). Many believe that major economic and societal changes will be led by entrepreneurs. Especially, new environmentally friendly businesses are assumed to be the first approach to present challenges in older industrial economies (Hall et al., 2010).

Sustainable entrepreneurs actively create innovative solutions for existing social and environmental issues, unlike established sustainable businesses that primarily aspire to reduce their negative environmental footprint (Cohen et al., 2006; Hall et al., 2010; Pacheco et al., 2009). Compared to traditional practices, green entrepreneurs do not solely measure their success by their financial performance, but rather strive for social, environmental and economic advancements (Cohen et al., 2006). Previous research also argued that green entrepreneurs are less restricted by traditional financial benchmarks, enabling them to better promote sustainability-driven practices as opposed to existing firms (Cohen et al., 2006; Hall et al., 2010). Many green advocates also claimed that green entrepreneurs will generate more job opportunities and increase economic growth by not only recognising market failures but also actively promoting the development of policies and frameworks that govern sustainable business practices and the allocation of environmental resources (Hall et al., 2010; Vodă & Florea, 2019).

Entrepreneurial Intention

A prerequisite for green entrepreneurial intention is the entrepreneurship mindset defined by De Pillis and Reardon (2007) as "the intention to start a new business". Intentionality itself is said to be the primary predictor of real behaviour (Vodă & Florea, 2019). More specifically, studies suggested that strong intentions increase the success of

behaviour prediction (Ajzen, 2002). Experts described Entrepreneurial Intention as deliberate and planned behaviour rather than a spontaneous decision, which is claimed to be a direct antecedent of entrepreneurial behaviour (Krueger et al., 2000; Ozaralli & Rivenburgh, 2016; Vodă & Florea, 2019).

Accordingly, choosing an entrepreneurial career can be viewed as a planned behaviour, as the decision to create a new business is a conscious decision that requires a high degree of cognitive processing, considerable planning and time (Ozaralli & Rivenburgh, 2016). To gain deeper insight into the development of such intentions, there are two main frameworks applied in studying entrepreneurial intention: The Theory of Planned Behaviour (TPB) by Ajzen and Shapero's Entrepreneurial Event Model (SEE) (Krueger et al., 2000; Vodă & Florea, 2019). The TPB suggests that three factors determine the development of entrepreneurial intentions: subjective norms, personal attitude towards outcome, and perceived behavioural control (Krueger et al., 2000; Mirjana et al., 2018; Ozaralli & Rivenburgh, 2016). The subjective norms refer to an individual's beliefs about the social desirability of being an entrepreneur (Mirjana et al., 2018), the personal attitude towards the outcome describes personal expectations about the consequences of being an entrepreneur (Krueger et al., 2000), and the perceived behavioural control is defined by an individual's expectations of their competence in a possible future entrepreneurial role (Autio et al., 2001; Mirjana et al., 2018). Shapero's Entrepreneurial Event Model (SEE) claims that entrepreneurial intentions are driven by desirability and feasibility as well as by the propensity to act upon opportunities (Krueger et al., 2000). Desirability is defined as an individual's attraction towards entrepreneurship, feasibility describes an individual's evaluation of their competence in performing entrepreneurial activities, and the propensity to act upon opportunities refers to the personal inclination to execute a decision (Ozaralli & Rivenburgh, 2016).

Further research suggested that individual and environmental factors also affect the development of entrepreneurial intention. According to Ozaralli & Rivenburgh (2016), personality is a strong predictor of entrepreneurial intention. More specifically, personality traits like optimism, innovativeness and risk-taking are suggested to be strongly associated with entrepreneurial intention (Ozaralli & Rivenburgh, 2016). Researchers also claimed that cultural environment and family backgrounds influence attitudes and personal traits and, therefore, indirectly affect an individual's entrepreneurial intention (Ozaralli & Rivenburgh, 2016).

Within the context of green entrepreneurship, the individual and environmental factors can be assumed to still be applicable. However, the decision-making process is more intricate due to the complex sustainable challenges green entrepreneurs face (Uvarova et al., 2021). Given these additional challenges, strategic adaptability and problem-solving skills, which are both enhanced by metacognitive awareness, seem to be essential for green entrepreneurs (Uvarova et al., 2021; Zepeda & Nokes-Malach, 2023). This suggests that metacognitive awareness might play a crucial role in developing green entrepreneurial intention.

Metacognitive Awareness

Metacognition describes an individual's awareness of their cognitive processes and ability to manage their learning on a conscious level (Papaleontiou-Louca, 2003; Schraw & Dennison, 1994). Previous studies have distinguished metacognition into two main elements: Knowledge about Cognition and Regulation of Cognition (Schraw & Dennison, 1994). Knowledge of cognition describes an individual's awareness of the interaction between themselves, the task at hand and the possible strategies (Veenman, 2015) and consists of three sub-components (Schraw & Dennison, 1994). The components are declarative knowledge, procedural knowledge, and conditional knowledge (Çini et al., 2023). Declarative knowledge

refers to the knowledge about one's cognition, what it is affected by and the knowledge about possible strategies (Çini et al., 2023; Schraw & Dennison, 1994). Procedural knowledge describes the knowledge of how to apply strategies to achieve certain goals and acquire new knowledge to increase academic success (Çini et al., 2023; Schraw & Dennison, 1994). Lastly, conditional knowledge is about the understanding of when, why and how to apply knowledge and strategies while considering external conditions (Çini et al., 2023; Schraw & Dennison, 1994).

The regulation of cognition concerns the conscious control of learning processes and includes five subprocesses: planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation (Schraw & Dennison, 1994). Planning occurs prior to a task and involves goal setting and thinking of possible strategies and resources (Papaleontiou-Louca, 2003; Schraw & Dennison, 1994). Afterwards, information management occurs and describes the conscious, efficient processing of information using specific skills and strategies (Schraw & Dennison, 1994). The next step consists of monitoring the learning, which involves the assessment and revision of learning progress and strategy use (Papaleontiou-Louca, 2003; Schraw & Dennison, 1994). After successful monitoring, debugging is applied, which aims to correct comprehension and performance errors (Schraw & Dennison, 1994). Finally, the outcomes of a learning episode are evaluated by analysing the effectiveness of the applied strategies (Schraw & Dennison, 1994).

Studies suggested that self-regulation is an essential element of metacognitive awareness and is positively correlated with effective problem-solving (Çini et al., 2023; Zepeda & Nokes-Malach, 2023). Additional research showed that metacognitively aware learners present better learning performance than others (Çini et al., 2023; Schraw & Dennison, 1994). Previous studies described metacognitive awareness as a skill used to reach a goal by identifying necessary resources and strategies and combining these with self-

regulation strategies (Çini et al., 2020). Additionally, successful self-regulated learners are able to adapt to environmental demands and improve their outcomes (Çini et al., 2020). Characteristics of green entrepreneurs have been described similarly. According to previous research, important characteristics of green entrepreneurs are recognising environmental values and effectively adopting and implementing these (Uvarova, 2021). One of the major entrepreneurial goals is addressing market failure, which requires prior analysis of the market to identify the failure and then a problem-solving approach to address the market failure successfully (Hall et al., 2010).

Considering the similarities between metacognitive skills and the essential characteristics of sustainable entrepreneurs, metacognitive awareness might be significant for green entrepreneurial intention.

Current Study

None of the presented studies investigated the relationship between an individual's metacognitive process and their entrepreneurial intentions, specifically their green entrepreneurial intentions. Due to the limited previous research, this study adopts an exploratory approach to investigate a potential relationship between the adoption of green entrepreneurial intention and metacognitive awareness among students. In particular, it seeks to identify which specific elements of metacognitive awareness are most influential in developing green entrepreneurial intention. This study focuses on university students, since studies have shown that educational institutions play a primary role in fostering entrepreneurial skills (Bonaccorsi et al., 2013; Brigmane, 2019). Research also suggested that promoting pro-environmental behaviour is essential to prepare students for the shifting economy (Tadena & Salic-Hairulla, 2021).

Accordingly, the following research questions will be investigated:

1. How does metacognitive awareness influence the adoption of green entrepreneurial intention in university students?
2. What specific aspects of metacognitive awareness are most associated with green entrepreneurial intention in university students?

Methods

Design

This study adopts a cross-sectional survey design conducted using a quantitative, non-experimental, correlational design. This design can be justified since it allows the investigation of naturally occurring differences in metacognitive awareness between individuals without the manipulation of variables. The study aims to examine whether there is a relationship between metacognitive awareness and green entrepreneurial intentions in university students. Furthermore, it is of interest whether the different components of metacognitive awareness correlate differently with green entrepreneurial intentions.

Participants

The sampling strategy used in this study was convenience sampling; the participants were recruited through the SONA System and the researchers' networks, mainly through social media. The experiment was ethically approved by the university board, and the participants were required to read and agree to an informed consent form before conducting the questionnaire. The inclusion criteria for this study were that the participants must currently be university students, give consent and complete the questionnaire.

A total of 107 participants participated in the study, of these 74 participants (69.2%) gave informed consent. After removing participants who failed to complete the entire questionnaire or did not meet the inclusion criteria of being a university student, a final sample of 47 participants (43.9%) remained. The final sample consisted of 30 female (63.8%) participants, 15 male (31.9%) participants, and 2 (4.6%) participants stated to be

non-binary or a third gender. The ages of the participants ranged from 18-28 years *(M_{age} = 22.85, SD_{age} = 2.1)*. Overall, 4 (8.5%) participants were Dutch, 30 (63.8%) were German, and 13 (27.7%) had another ethnicity.

Variables

To investigate the correlation between metacognitive awareness and green entrepreneurial intentions, *Metacognitive Awareness* as the predictor variable and *Green Entrepreneurial Intention* as the dependent variable were tested. To study which specific subcomponent of metacognitive awareness might have a stronger relationship with green entrepreneurial intention, eight predictor variables were measured. More specifically, the eight subcomponents of metacognitive awareness such as *Declarative Knowledge, Procedural Knowledge, Conditional Knowledge, Planning, Information Management Strategies, Monitoring, Debugging, and Evaluation.*

To determine the participant's metacognitive awareness and whether certain subcomponents are more prominent, the *Metacognitive Awareness Inventory (MAI)* developed by Schraw and Dennison (1994) was adopted. Since no scale has been developed to measure green entrepreneurial intentions, the existing scale, *Entrepreneurial Intention Questionnaire (EIQ),* developed by Liñán and Chen (2009), which measures general entrepreneurial intention, has been adjusted accordingly. For instance, one of the adapted items originally read "A career as an entrepreneur is attractive to me" and was altered to "A career as a green entrepreneur is attractive to me".

Material

To ensure efficient data collection and accessibility, an online questionnaire via the "Go-Lab" learning environment was used. Firstly, the participants were informed that all responses would remain private to ensure confidentiality and anonymity throughout the data collection. The questionnaire consisted of multiple demographic questions and was followed

by the Metacognitive Awareness Inventory (MAI). The MAI includes 52 dichotomous items, which could be answered with “True”, which was coded as 1 and “False”, being coded as 2. Afterwards, the participants were presented with a brief case scenario which described a sustainable firm of a green entrepreneur facing sustainable business dilemmas. This case was included to activate participants’ thinking about the real-world context of green entrepreneurship and to ensure consistent understanding before responding to the Green Entrepreneurial Intention Questionnaire (GEIQ). The GEIQ consists of 17 items, which were asked to be answered on a 7-point Likert scale ranging from 1 (*Strongly Disagree)* to 7 (*Strongly Agree*). The 7-point Likert scale allowed the participants to express their agreement in a nuanced manner. The survey was made available in English since the questionnaire was shared with participants with different backgrounds who speak different languages.

Procedure

At the start of the study, the participants were informed about the purpose, the procedure, how their data would be stored and used, and that their participation was entirely voluntary. The participants were asked to read this information carefully and then state if they consented to the use of their data for research purposes. After giving consent, the participants were asked to answer demographic questions, such as information about their gender, age, occupation, and ethnicity. Afterwards, the metacognitive awareness was measured using the MAI. Here, the participants were instructed to answer 52 dichotomous questions with “Yes” or “No” as response options. Following the MAI, the case of the sustainable business was introduced. To finish the questionnaire, the GEIQ was presented, measuring the green entrepreneurial intention. The participants were asked to answer the 17 questions on a 7-point Likert scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Once all questions were answered, the participants were thanked for taking part in the study. Overall, the study was estimated to be completed in 10 to 15 minutes.

Data Analysis

To analyse the collected data, RStudio was utilised, including the packages tidyverse and dplyr. In preparation for the data analysis, responses with missing consent, incomplete responses, and responses from participants who are currently not students were removed from the original dataset. To answer the first research question, descriptive statistics were analysed to gather information about the overall results of MAI and the GEI. Afterwards, a Pearson's correlation was conducted to examine whether there is a significant relationship between *Metacognitive Awareness* and *Green Entrepreneurial Intention,* and to determine its direction.

In order to understand the relationship between the two variables, the correlation coefficient and the significance of the p-value were observed. Then, a simple linear regression was used to gain insight on the strength of the relationship and the degree of variance explained by the model. To determine the relationship, the regression coefficient and the value for R^2 were considered.

In order to answer the second research question, the descriptive statistics of each subcategory of the MAI were examined, and a Pearson correlation matrix was computed. The correlation matrix was used to examine the individual bivariate correlation between each MAI subscale and green entrepreneurial intention. Finally, a multiple linear regression analysis was conducted to examine which subcategory of *Metacognitive Awareness* might be most strongly related to *Green Entrepreneurial Intention*, and if specific categories could predict stronger green entrepreneurial intention. Furthermore, multicollinearity diagnostics were run to investigate potential multicollinearity within the variables. Here, the regression coefficient, the value for R^2, the significance of the p-value, and the variance inflation factor are observed for each category.

Results

1. *How does metacognitive awareness influence the adoption of green entrepreneurial intention in university students?*

To address RQ1 first, descriptive statistics were observed to gain an overview of the gathered data. The mean score for the variable "Metacognitive Awareness" was 1.27 *(SD = 0.37)*, since "True" was coded as 1 and "False" as 2, these results show relatively high levels of metacognitive awareness among the participants. With a mean score of 2.70 *(SD = 1.54)*, participants demonstrate a rather low level of green entrepreneurial intention. Still, the large standard deviation suggests significant variability in responses.

To answer the first research question, "*How does metacognitive awareness influence the adoption of green entrepreneurial intention in university students?"*, a Pearson correlation analysis was conducted. The correlation analysis revealed a small-to-moderate positive relationship between metacognitive awareness and green entrepreneurial intention, $r(45) = .29$, $p = .047$.

Afterwards, a simple linear regression analysis was conducted to further examine the predictive relationship between the two variables. The regression model was statistically significant, $F(1,45) = 4.17$, $p < .05$ and suggested a positive correlation between metacognitive awareness and green entrepreneurial intention, $b = 1.32$, $t(45) = 2.04$, $p = 0.047$. These results indicate that green entrepreneurial intention increases by approximately 1.32 units for each unit increase in metacognitive awareness. Furthermore, the R^2-value of 0.085 shows that metacognitive awareness explains approximately 8,5% of the variability in green entrepreneurial intention. Even though the regression model was statistically significant, an R^2-value of 0.085 only has limited predictive power, suggesting that other variables also influence green entrepreneurial intentions.

2. *What specific aspects of metacognitive awareness are most associated with green entrepreneurial intention in university students?*

To provide an overview of the collected data (n = 47), first, descriptive statistics for each of the eight subcategories of the MAI were calculated. The descriptive results are presented in Table 1. Then, a correlation analysis was performed by computing a Pearson correlation matrix, in order to analyse the bivariate correlation between each MAI subscale and green entrepreneurial Intention. Among the eight subscales, *Conditional Knowledge* (*r* = .37) and *Debugging Strategies* (*r* = .37) show the strongest correlation with GEI. Additionally, *Information Management* (*r* = .33) shows a small-to-moderate positive association with GEI. The remaining subscales demonstrated weaker associations ranging from r = .13 to .25 (see Appendix 1 for full matrix).

Table 1

Descriptive Statistics for MAI Subscales

Subscale	Mean (M)	Standard Deviation (SD)
Declarative Knowledge	1.26	0.38
Procedural Knowledge	1.21	0.39
Conditional Knowledge	1.22	0.37
Planning	1.33	0.41
Information Management Strategies	1.15	0.35
Monitoring	1.19	0.37
Debugging Strategies	1.06	0.37
Evaluation	1.28	0.42

Note. True = 1; False = 2. Lower values = higher metacognitive awareness.

Additionally, a multiple regression analysis was conducted to analyse whether there is a unique predictive effect for each metacognitive awareness subscale on green entrepreneurship. The analysis indicated that the overall model accounts for approximately 25% of the variation in green entrepreneurial intention (R^2 = 0.249; adjusted R^2 = 0.091). The adjusted R^2 of 0.091 suggests a low model fit, indicating that the model explains some variance but lacks statistical reliability.

Moreover, the analysis also revealed that the overall model was not statistically significant, F (8,38) = 1.58, p = .164. Furthermore, none of the eight subscales reached statistical significance (all p >.05), indicating no unique predictive value within the model. Even though *Conditional Knowledge* (b = 1.68, p = 0.187) as well as *Debugging Strategies* (b = 1.61, p = 0.218) display the strongest positive predictive effect, neither of them reached statistical significance.

Discussion

This study explored whether there is a relation between metacognitive awareness and Green Entrepreneurial Intention (GEI). It also attempts to identify which specific subscales of metacognitive awareness are most applicable to GEI. With a focus on university students, this study aimed to offer a deeper insight into which skills need to be fostered the most when teaching students about environmentally friendly entrepreneurship.

RQ1: How does Metacognitive Awareness Influence the Adoption of Green Entrepreneurial Intention among University Students?

Pearson's correlation coefficient revealed a statistically significant, small-to-moderate positive correlation between the participants' overall metacognitive awareness and their green entrepreneurial intentions. A simple linear regression suggested that higher metacognitive awareness predicted a modest increase in GEI, explaining approximately 8.5% of the variance. Although the predictive power is limited, it supports the hypothesis that

metacognitive awareness skills have a meaningful effect in fostering students' interest in pursuing sustainable entrepreneurship.

These findings align with existing literature describing reflective thinking and strategic adaptability as essential competencies of green entrepreneurs (Uvarova et al., 2021). High metacognitive awareness skills directly correlate with strategic planning, problem-solving skills, and self-evaluation, which are crucial for navigating environmental challenges (Flavell, 1979; Çini et al., 2020).

A possible theoretical explanation for these findings could be inferred from the Theory of Planned Behaviour by Ajzen (Ajzen, 2002). This model suggests that entrepreneurial intention is determined by an individual's perceived behavioural control, subjective norm and their personal attitude towards the outcome (Krueger et al., 2000; Mirjana et al., 2018; Ozaralli & Rivenburgh, 2016). Metacognitive awareness might influence a student's perceived behavioural control by fostering strategic planning, self-reflection and adaptive decision making. These metacognitive processes may also strengthen students' confidence in their competence to face sustainability challenges and pursue green entrepreneurship. People with higher metacognitive awareness might also have a more positive personal attitude towards the outcome of being a sustainable entrepreneur, by being more capable of aligning and evaluating their actions with their long-term goals. This could explain the association of stronger green entrepreneurial intention with higher metacognitive awareness.

Overall, the findings of the current study offer empirical support for including cognitive self-regulation tasks into entrepreneurial education, especially within sustainability-focused programs.

RQ2: What specific aspects of metacognitive awareness are most associated with green entrepreneurial intention in university students?

Although the results of the multiple regression analysis did not show statistically significant predictors among the eight subcomponents of the Metacognitive Awareness Inventory, the bivariate correlation showed promising directions. The subscales, *Conditional Knowledge* and *Debugging Strategies,* showed the strongest positive correlation with GEI, followed by *Information Management Strategies*.

Conditional Knowledge describes the learner's ability to recognise when and why certain strategies should be used (Çini et al., 2023; Schraw & Dennison, 1994). This skill might be valuable for future green entrepreneurs when navigating the uncertainties and dynamic challenges of sustainable entrepreneurship. *Debugging Strategies* refers to the ability to identify and correct errors (Schraw & Dennison, 1994), which is critical when developing innovations and problem-solving, which are both key characteristics of green entrepreneurship (Uvarova et al., 2021).

The discrepancy between the results of the regression analysis and the bivariate correlations could be explained by multicollinearity. In this case, multicollinearity describes the subscales' correlation with each other and how their variances overlap. Consequently, a multiple linear regression cannot isolate unique predictive values for each subscale, as they are empirically and theoretically interrelated. Even though this limits the investigation of the unique contributions of the subscales, it still provides relevant insights.

Overall, these findings suggest that fostering students' metacognitive capacities might positively affect their intention to pursue sustainable entrepreneurship. More specifically, helping students improve their conditional knowledge and debugging strategies may be critical to prepare them for the complex challenges of green entrepreneurship. Incorporating metacognitive training in entrepreneurial education could increase the number of future entrepreneurs with the capability to successfully address sustainability challenges. Accordingly, fostering metacognitive skills could affect individuals' green entrepreneurial

intentions while also contributing to the innovation of environmentally friendly businesses, which would have a positive impact on the global climate crisis.

Theoretical and Practical Implications

This study contributes to the extension of existing literature by creating a link between metacognitive awareness and green entrepreneurship, which has been rarely investigated together previously. The findings support the assumption that metacognitive skills can increase students' motivation to pursue sustainable entrepreneurship. They also provide evidence aligning with existing models, like the Theory of Planned Behaviour (Ajzen, 2002), suggesting that components such as attitude towards sustainable entrepreneurship and perceived behavioural control might be influenced by metacognitive awareness.

Regarding entrepreneurial education, these findings propose that the incorporation of metacognitive training could positively impact green entrepreneurial intentions among students. By teaching and strengthening students' abilities to actively identify errors and select appropriate strategies to correct those errors, the programs would better prepare students for the potential risks and challenges of green entrepreneurship. These programs could foster metacognitive awareness, specifically conditional knowledge and debugging strategies, by working with real-life scenario-based exercises and reflective tasks to teach critical and adaptive problem-solving.

Limitations

The current study has multiple methodological limitations and technical issues that caused further limitations. The first methodological limitation is the small sample size. After excluding all data that did not meet the inclusion criteria, the final sample consisted of 47 participants. This rather small sample size considerably limits the generalisability and the statistical power of the obtained results, increasing the risk of a Type II error. The other

methodological limitations regard the cross-sectional design and self–reported data. Due to the cross-sectional design, causality cannot be inferred, since confounding variables cannot be controlled for. Additionally, when doing a single-time assessment, it is only possible to examine if there is a correlation between the variables and not which variable might predict the other. Furthermore, the self-report data also affects the reliability of the results since they could be subject to the social desirability bias and therefore might not reflect the actual effect.

The first technological issue of the study was that the program that was used for the questionnaire was not compatible with mobile devices. Since the study was mainly shared over social media platforms, most participants accessed the questionnaire with their mobile devices, which could explain the low completion rate and could have affected the response quality. Several participants reported that they could only see a white screen when opening the link, which could explain why a considerable number of participants opened the link but did not proceed to do the survey. Additionally, while doing the survey, only part of the screen was visible, and moving the screen in order to see the questionnaire in its entirety was very challenging. This resulted in only the left part of the scale being visible and easily accessible, whereas the right side of the scale, more specifically columns 5 (*Somewhat Agree*) to 7 (*Strongly Agree*), was difficult to access. This could have affected the answers of the participants, limiting the reliability of the results.

Along with the mobile layout of the program, the navigation of the survey was an additional issue in this study, resulting in limitations. The participants were able to navigate between the individual components of the survey without having to finish the previous components. As a consequence, almost a third of the participants had to be removed since they skipped the informed consent without agreeing, even though they proceeded to do the survey. Moreover, it is possible that the participants could have done the questionnaire in a

different order than originally intended, which could have affected the results and limited their reliability.

Future Directions

Considering the knowledge gathered during this research, multiple recommendations could be made for future studies. In a general sense, the study could be replicated with a larger and more diverse sample to increase the statistical power of the study and increase the generalisability. To increase accessibility and completion rates, future replication studies should also use a program that is compatible with mobile devices. Furthermore, it is recommended to adjust the design by making it a requirement to answer every question before continuing to the next component to ensure that the survey is completed in the intended order.

In order to increase the value of the results and explore the causality, the study could also be extended by adopting an experimental or longitudinal design. This way, future studies could examine whether there is an increase in green entrepreneurial intentions when including metacognitive training interventions. For example, future research could conduct an experimental study by employing a between-group longitudinal approach. Three groups could be investigated: two groups with metacognitive strategy interventions, each group fostering either metacognitive knowledge or metacognitive regulation, and a third group without metacognitive training.

Future studies could also extend their research by including qualitative interviews to investigate individuals' reasoning and gain deeper insights into students' individual opinions on sustainability and entrepreneurship.

Additionally, more sophisticated statistical models, such as structural equation modelling, could be used to examine the mediating and moderating roles of variables like

self-efficacy, personal values, or sustainability beliefs in the relationship between metacognition and green entrepreneurial intention.

Conclusion

The purpose of this study was to investigate whether there is a correlation between metacognitive awareness and green entrepreneurial intention, as well as to examine whether specific subcomponents of metacognitive awareness could be more directly linked to sustainable entrepreneurial thinking. This study first measured the metacognitive awareness levels and the individual strength of the eight subcomponents of metacognition. Afterwards, the participant's intention to pursue green entrepreneurship was examined. Although the findings suggest a modest effect, metacognitive awareness still has a meaningful role in the development of green entrepreneurial intentions. More specifically, the study revealed that the subcomponents *Conditional Knowledge* and *Debugging Strategies* are most strongly related to green entrepreneurial intention. Overall, these findings contribute to advancing research by recognising metacognitive awareness, particularly conditional knowledge and debugging strategies, as critical elements in fostering green entrepreneurial intention. Despite its exploratory character, the study offers evidence that encourages the integration of metacognitive training in educational settings.

These findings add to existing research by connecting green entrepreneurial intentions with metacognitive awareness. Furthermore, this study identified the two subcomponents, conditional knowledge and debugging strategies, as skills that have the strongest association with green entrepreneurial intention in students and could potentially be fostered in educational settings. The insight gained from this study can contribute to the development of a theory explaining the relationship between cognitive skills and green entrepreneurship. The knowledge gained about the effect of the two subcomponents can also be relevant for the design of educational programs, especially in entrepreneurship education, to promote

sustainable entrepreneurial intentions. For example, metacognitive exercises, such as strategic planning exercises, would foster conditional knowledge. While scenario-based problem solving may encourage the skill of debugging strategies by practising to identify and correct errors, enforcing metacognitive training programs in educational settings could also be an effective tool to address the climate crisis and foster sustainability.

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Appendix A

Table 2

Pearson Correlation Matrix between MAI and GEI

Variable	1	2	3	4	5	6	7	8	9
1.GEI	—								
2.Declarative Knowledge	0.133	—							
3.Procedural Knowledge	.252	.742	—						
4.Conditional Knowledge	.368	.749	.743	—					
5.Planning	.251	.750	.769	.808	—				
6.Information Management Strategies	.331	.769	.777	.848	.808	—			
7.Monitoring	.242	.713	.730	.726	.822	.837	—		
8.Debugging Strategies	.370	.701	.694	.789	.773	.881	.794	—	
9.Evaluation	.178	.648	.654	.686	.730	.807	.787	.759	—

Note. GEI = Green Entrepreneurial Intention; Values represent Pearson correlation coefficients.

Appendix B

Consent Form

Information form for Participant
This study is performed by Viola Kershi, a student under the supervision of Ahsen Çini at the University of Twente. Before participating, you are asked to carefully read the information below and give your informed consent for voluntary participation.

Aim of the study
This study aims to investigate metacognitive awareness and how it relates to green entrepreneurial intention in university students. It also intends to measure which specific aspect of metacognitive awareness is mostly associated with green entrepreneurial intention in students.

Procedure
This research consists of a survey with multiple sections. First, you will be asked to answer a questionnaire measuring metacognitive awareness. Afterwards, a hypothetical case will be presented, followed by a questionnaire measuring your green entrepreneurial intentions. Completing this study will take approximately 30 minutes.

Risk
This study does not involve risks, detrimental side effects, or causes of discomfort.

Voluntary Participation
Your participation is completely voluntary. You can stop your participation at any time without giving any reasons. You can also withdraw your permission to use your data up to 24 hours after it has been recorded. None of this will have any negative consequences for you whatsoever.

Confidentiality and use, storage, and sharing of data
This study has been approved by the BMS Ethics Committee of the University of Twente. Personal Data (E.g., age, gender, occupation) and experimental data (your responses to the survey) obtained in this study will be anonymised and handled with confidentiality. The anonymised dataset that will not contain information that can identify you will contribute to this research.

All personal data collected during the study will be handled anonymously. The information gathered will be used solely for research purposes. The responses will remain confidential, and no identifying details will be linked to the data. After analysis, all data will be securely deleted.

Further Information
If there are further questions about the use of data collected or the progress of this research, you can contact Viola Kershi (v.kershi@student.utwente.nl). If you want to send a filed complaint, please contact the BMS Ethics Committee: ethicscommittee-bms@utwente.nl.

I indicate that I have read and understood the study procedure, and I agree to voluntarily participate. My responses can be used for the purpose of this study.

- Yes
- No

If you accept the terms, you can go to the demographic section.

Demographics

We would like to know some demographic information about you.

What is the gender you identify with?

- Female
- Male
- Non-binary/third gender
- Prefer not to say

What is your age in Years?

_____

What is your current employment status? (If you are a full-time university student with a job, please choose "Student")

- Employed full-time (40+ hours a week)
- Employed part-time (less than 40 hours a week)
- Unemployed currently not working
- (University) Student
- Retired
- Self-employed
- Other ____

What is your ethnic background?

- Dutch
- German
- Other____

After answering the questions about your demographic information, you can continue with the Metacognitive Awareness Inventory Part.

Metacognitive Awareness Inventory (MAI)

We would like to know more about your learning habits and awareness.

Please think of yourself as a learner. Read each statement carefully. Consider if the statement is true or false as it generally applies to you when you are in the role of a learner (Student, attending classes, university, etc.) Check (✓) True or False as appropriate.

1. I ask myself periodically if I am meeting my goals.
    - True
    - False

2. I consider several alternatives to a problem before I answer.

- True
- False

3. I try to use strategies that have worked in the past.
    - True
    - False

4. I pace myself while learning in order to have enough time.
    - True
    - False

5. I understand my intellectual strengths and weaknesses.
    - True
    - False

6. I think about what I really need to learn before I begin a task.
    - True
    - False

7. I know how well I did once I finish a test.
    - True
    - False

8. I set specific goals before I begin a task.
    - True
    - False

9. I slow down when I encounter important information.
    - True
    - False

10. I know what kind of information is most important to learn.
    - True
    - False

11. I ask myself if I have considered all options when solving a problem.
    - True
    - False

12. I am good at organizing information.
    - True
    - False

13. I consciously focus my attention on important information.
    - True
    - False

14. I have a specific purpose for each strategy I use.
    - True
    - False

15. I learn best when I know something about the topic.
    - True
    - False

16. I know what the teacher expects me to learn.
    - True
    - False

17. I am good at remembering information.
    - True
    - False

18. I use different learning strategies depending on the situation.
    - True
    - False

19. I ask myself if there was an easier way to do things after I finish a task.
    - True
    - False

20. I have control over how well I learn.
    - True
    - False

21. I periodically review to help me understand important relationships.
    - True
    - False

22. I ask myself questions about the material before I begin.
    - True
    - False

23. I think of several ways to solve a problem and choose the best one.
    - True
    - False

24. I summarize what I've learned after I finish.
    - True
    - False

25. I ask others for help when I don't understand something.
    - True
    - False

26. I can motivate myself to learn when I need to.
    - True
    - False

27. I am aware of what strategies I use when I study.
    - True
    - False

28. I find myself analyzing the usefulness of strategies while I study.
    - True
    - False

29. I use my intellectual strengths to compensate for my weaknesses.
    - True
    - False

30. I focus on the meaning and significance of new information.
    - True
    - False

31. I create my own examples to make information more meaningful.
    - True
    - False

32. I am a good judge of how well I understand something.
    - True
    - False

33. I find myself using helpful learning strategies automatically.
    - True
    - False

34. I find myself pausing regularly to check my comprehension.
    - True
    - False

35. I know when each strategy I use will be most effective.
    - True
    - False

36. I ask myself how well I accomplished my goals once I'm finished.
    - True
    - False

37. I draw pictures or diagrams to help me understand while learning.
    - True
    - False

38. I ask myself if I have considered all options after I solve a problem.
    - True
    - False

39. I try to translate new information into my own words.
    - True
    - False

40. I change strategies when I fail to understand
    - True
    - False

41. I use the organizational structure of the text to help me learn.
    - True
    - False

42. I read instructions carefully before I begin a task.
    - True
    - False

43. I ask myself if what I'm reading is related to what I already know.
    - True
    - False

44. I reevaluate my assumptions when I get confused.
    - True
    - False

45. I organize my time to best accomplish my goals.
    - True
    - False

46. I learn more when I am interested in the topic.
    - True
    - False

47. I try to break studying down into smaller steps.
    - True
    - False

48. I focus on overall meaning rather than specifics.
    - True
    - False

49. I ask myself questions about how well I am doing while I am learning something new.
    - True
    - False

50. I ask myself if I learned as much as I could have once I finish a task.
    - True
    - False

51. I stop and go back over new information that is not clear.
    - True
    - False

52. I stop and reread when I get confused.
    - True
    - False

You may now proceed with the next section.

Case Study: Green Living

In the section below, you will find information regarding the Case Study: *Green Living*. Please read it carefully. After reading the material, you will see a question.

You are starting a business producing wooden furniture, which is already somewhat successful. The focus of your company is to make environmentally friendly and affordable furniture. You use sustainable materials, slow low-energy machines and produce locally. The production itself is way more expensive and significantly slower than mass-producing furniture with unsustainable materials in a country with lower production costs. Additionally,

the demand for your furniture is increasing rapidly, and it's getting harder to keep up with the number of orders. Since one of the company's main goals is to sell affordable furniture, the sold furniture does not lead to a big profit, and the higher demand doesn't increase the profit either since you can't produce at that pace.

You may now proceed with the last part, measuring your green entrepreneurial Intention.

Green Entrepreneurial Intention

We would like to know about your intentions and motivation related to green entrepreneurship.

Please read each statement carefully and answer honestly – there are no right or wrong answers.

1. *Personal Attitude*

Indicate your level of agreement with the following sentence from 1 (total disagreement) to 7 (total agreement)

1.a- Being a sustainable entrepreneur implies more advantages than disadvantages to me

1.b- A career as a green entrepreneur is attractive to me

1.c- If I had the opportunity and resources, I'd like to start a sustainable firm

1.d- Being a green entrepreneur would entail great satisfaction for me

1.e- Among various options, I would rather be a green entrepreneur

2. *Perceived Behavioural Control*

Indicate your level of agreement with the following sentence from 1 (total disagreement) to 7 (total agreement)

2.a- To start a sustainable firm and keep it working would be easy for me

2.b- I am prepared to start a viable, sustainable firm

2.c- I can control the creation process of a new sustainable firm

2.d- I know the necessary practical details to start a sustainable firm

2.e- I know how to develop a green entrepreneurial project

2.f- If I tried to start a sustainable firm, I would have a high probability of succeeding

3. *Green Entrepreneurial Intention*

Indicate your level of agreement with the following sentence from 1 (total disagreement) to 7 (total agreement)

3.a- I am ready to do anything to be a green entrepreneur

3.b- My professional goal is to become a green entrepreneur

3.c- I will make every effort to start and run my own sustainable firm

3.d- I am determined to create a sustainable firm in the future

3.e- I have very seriously thought of starting a sustainable firm

3.f- I have the firm intention to start a sustainable firm someday