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The Role of Social Interaction in Community Gardening: Effects on Pro-Environmental Social Identity Formation and Behavioral Intentions Among University Students

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Abstract

Community gardens are increasingly recognized as promising grassroots interventions for promoting pro-environmental behavior (PEB). While prior research has focused on direct participants, this study examined whether observing social interaction in gardening contexts can foster pro-environmental social identity (PESI) and behavioral intentions among non-participating university students. Participants (N = 171) were randomly assigned to view one of three conditions: individual gardening, non-interactive community gardening, or socially interactive community gardening. There were no significant effects of condition on PESI components (pro-environmental norms, community identification, collective efficacy). PESI was, however, positively associated with both individual and collective PEB intentions. Notably, participants exposed to socially interactive gardening reported higher individual PEB intentions than those in the non-interactive condition when controlling for PESI. These findings suggest that while PESI may not emerge through passive observation, visible social engagement in sustainability practices can still motivate behavioral intentions through affective or observational pathways.

Introduction

In the midst of societal disconnect from both nature (Ives et al., 2018) and each other (Komatsu et al., 2019), community gardening is emerging as a promising avenue to rebuild these fractured relationships. Community gardens are collectively maintained green spaces typically situated in urban areas, where local residents engage in the cultivation of food and other plants. Previous research has primarily focused on their role in climate adaptation by strengthening urban resilience and providing food security (Clarke et al., 2019; Firth et al., 2011); however, community gardens hold the potential to increase pro-environmental intentions on a broader scale: gardening has consistently been linked to heightened connectedness to nature (Kilfeather, 2021; Turner, 2011), a key predictor of pro-environmental action (Guazzini et al., 2025). Additionally, community gardens provide spaces for members to interact with one another (Firth et al., 2011), which helps build a sense of belonging and shared environmental responsibility, which then motivates people to act more sustainably (Jans, 2021; Thomas et al., 2016).

Community-driven sustainability initiatives are increasingly recognized as important complements to policy-driven efforts in addressing climate change. These communities have been shown to encourage pro-environmental values among their members (Jans, 2021), but they may face barriers to broader societal engagement due to the negative stereotypes associated with their explicit sustainability focus (Bashir et al., 2013). In contrast, community gardens center around widely shared values such as food security, nature, and social connection (Clarke et al., 2019; Kilfeather, 2021). Their appeal to universal values offers a more inclusive and accessible space for the formation of pro-environmental social identities (Kilfeather, 2021).

Gardening has been linked to heightened environmental awareness (Turner, 2011). Community gardening may amplify these effects through its collective nature, especially

when it provides room for social interaction (Kilfeather, 2021). However, few people actively participate in community gardening. This raises an important question: Can the pro-environmental benefits of such socially engaged, sustainable spaces extend to their broader communities? The current thesis investigates whether visible social interaction in community gardening influences observers' sense of environmental identity and motivation to act sustainably.

1. Literature Review

1.1. The Relevance of Pro-Environmental Social Identities for Pro-Environmental Behavior

When individuals identify with a group, they internalize its values and are more likely to align their behavior with its norms (Tajfel & Turner, 1979). Pro-environmental social identities (PESI) are part of an individual's self-concept derived from perceived membership in a social group with shared environmental values, norms, and goals (Fritsche et al., 2018). PESI has three core components: *Pro-environmental group norms* (both injunctive - what is socially approved, and descriptive - what others typically do) are critical for guiding behavior (Cialdini et al., 1991). The salience of these norms increases through social interaction, particularly in contexts where sustainable practices are publicly visible and discussed. *Community identification* is the extent to which individuals see themselves as part of a group (Fritsche et al., 2018). It forms through interaction and shared experiences that cultivate emotional connection (Postmes et al., 2005). *Collective efficacy* reflects the belief that one's group can effectively respond to environmental challenges (van Zomeren et al., 2004). This belief is both cognitive and affective and comes not only from rational appraisal but also from emotional engagement and inspiration drawn from group activities (Masson & Fritsche, 2021). Bandura (1997) describes this as "reciprocal causality", wherein successful collaboration enhances confidence in a group's capacity, encouraging further cooperation.

The more strongly one identifies with a group that has pro-environmental norms, and the more efficacious that group is perceived to be, the more likely both individual and collective pro-environmental behaviors (PEB) are to occur (Fritsche et al., 2018; Masson & Fritsche, 2021). Pro-environmental norms drive individual and collective PEB because they create social pressure and motivation to follow them, both in private and public spheres. According to the inductive pathway of social identity formation, norms are co-created (Postmes et al., 2005), which makes them resilient, sets strong behavioral standards, and drives coordinated collective climate action (Fritsche et al., 2018; Masson & Fritsche, 2021). Community identification drives individual and collective PEB because behaviors function as expressions of a collective sense of self (Fritsche et al., 2018). Once individuals start identifying with an environmentally conscious group, it becomes a personal motivation to conform to the group's identity. Conforming to the group also results in participation in group-based environmental actions (Fritsche et al., 2018). Collective efficacy drives individual and collective PEB because the belief in a group's ability to create meaningful change increases motivation and personal engagement, enabling group mobilization, cooperation, and persistence (Fritsche et al., 2018; Teig et al., 2009).

1.2. Community Gardens as Spaces for PESI Formation

Individuals often underestimate how much others care about sustainability, which can hinder norm internalization and reduce motivation to act (Bouman et al., 2021). I argue that community gardening can help correct these misconceptions and strengthen perceived environmental norms through repeated interaction and shared values. Community gardens facilitate norm formation by providing a context in which participants observe and engage in sustainable practices, thereby reinforcing what is socially expected and endorsed (Teig et al., 2009). In addition to shaping norms, community gardens have been shown to strengthen

community identification by fostering a sense of shared purpose and collective ownership (Firth et al., 2011). I argue that their socially interactive and cooperative nature allows environmental values to become embedded within the group identity. Furthermore, the shared responsibilities that characterize community gardening, such as planting, maintenance, and coordination, require mutual support and cooperation, which in turn reinforces perceptions of collective agency (Teig et al., 2009). Specifically, Kilfeather (2021) found that collective efficacy mediated the relationship between community gardening and individual pro-environmental behavior. I argue that community gardens are particularly well-suited to foster a sense of collective efficacy, as they provide repeated opportunities for collaborative sustainable action, which contributes to a shared belief in the group's competence to address environmental issues. While previous research has examined the individual effects of norms, community identification, and collective efficacy in community gardening contexts, few studies have systematically integrated these elements within the PESI framework. Kilfeather (2021) offers a preliminary foundation for such integration, yet the broader potential of community gardens to foster PESI and thereby influence wider pro-environmental engagement still warrants further empirical attention.

1.3. Social Interaction as a Core Mechanism of PESI Formation

According to the inductive model of social identity formation, social identity is not only deducted from group membership but also co-constructed through interactions and norm communication within the group (Postmes et al., 2005). Social interaction within groups reinforces pro-environmental norms, which are more likely to translate into sustained behaviors when strongly embedded in a meaningful group identity (Fritsche et al., 2018). Community gardens, particularly those with strong social orientation (e.g., incorporating communal spaces and social events), may provide a physical location for this, as they have

been shown to strengthen identification with the community by creating shared purpose and a space where members can interact with each other and co-create norms (Firth et al., 2011; Kingsley & Townsend, 2006). Additionally, the collaborative setting of community gardens also fosters a stronger sense of collective efficacy (Teig et al., 2009). A recent thesis by Kilfeather (2021) found that membership in socially oriented community gardens was associated with stronger community identification, perceived community efficacy, and higher PEB intentions, though it did not isolate the role of social interaction. However, increasing social interaction has been shown to strengthen PESI formation and PEB intentions in other experimental collaborative pro-environmental settings. Plechatá et al. (2025) found that social interaction through immersive virtual reality (VR) techniques increased identification with climate action supporters. Even when the social interaction did not explicitly focus on collective action, the social engagement itself crystallized the pro-environmental social identity, making participants more likely to embrace pro-environmental group norms. Jans et al. (2023) found that increasing social interaction during vegan cooking workshops facilitated the formation of a shared pro-veg*n social identity among schoolchildren and led them to perceive stronger pro-environmental norms at their school, which in turn strengthened their PEB intentions related to dietary choices. These studies point towards social interaction playing a crucial role in PESI formation.

1.4. Can PESI Formation Extend Beyond Direct Involvement?

While most research on PESI formation in the context of pro-environmental initiatives has focused on active participants, there is growing evidence suggesting that the influence of norms and identity cues may extend beyond those directly involved. Social norms formed in community gardens have been shown to spread throughout the broader community. Teig et al. (2009) found that relationships formed in the garden lead to informal

agreements to help one another both inside and outside the garden environment, in turn defining acceptable behaviors around the garden and neighborhood.

Observing social behavior can elicit perceptions of group cohesion and "togetherness," even among non-participants, which creates a vicarious sense of belonging and identification with the group (van Mourik Broekman, 2018). This aligns with the inductive pathway of social identity formation, which posits that group identity emerges through the contributions of individual members and becomes more relatable and enduring when co-constructed (Postmes, Haslam, & Swaab, 2005). Jans (2021) demonstrated that even among organizational members not directly involved in a green initiative, perceiving it as formed by the members themselves led to stronger identification with the organization and increased pro-environmental behavior.

Yet, there is currently no empirical research examining how visible social interaction within community gardens influences PESI formation in non-members. The current thesis aims to address this gap by exploring whether the degree of social interaction observed in community gardening settings contributes to PESI formation and subsequent PEB intentions among non-participants.

2. Present Study

The present study investigates how observing varying levels of social interaction in a community garden (individual gardening, non-interactive community gardening, and interactive community gardening) influences PESI formation and PEB intentions among students not yet participating in the community garden. Additionally, it explores whether having prior awareness of the community garden predicts differences in PESI and behavioral intentions. By examining both direct and indirect pathways of social influence, this research contributes to a deeper understanding of how social interaction in bottom-up sustainability

initiatives can drive environmental engagement on a broader scale. Therefore, I propose the following hypotheses:

H1: Gardening condition affects PESI (in terms of community pro-environmental norms, community identification, and collective efficacy).

H1a: Observing non-interactive community gardening will result in higher PESI than observing individual gardening.

H1b: Observing socially interactive community gardening will result in higher PESI than observing non-interactive community gardening.

H2: PESI (in terms of community pro-environmental norms, community identification, and collective efficacy) will be positively associated with:

H2a: Individual PEB intentions, and

H2b: Collective PEB intentions,

H3: PESI (in terms of community pro-environmental norms, community identification, and collective efficacy) will mediate the relationship between:

H3a: Gardening condition and individual PEB intentions, and

H3b: Gardening condition and collective PEB intentions.

3. Method

3.1. Procedure and Design

Participants were recruited via the University of Groningen's (UG) SONA system and were awarded 0.7 SONA credits for their participation. The target population consisted of first-year Psychology students from the Faculty of Behavioural and Social Sciences. The study was conducted online via Qualtrics between April 24 and June 1, 2025. Ethical approval was granted by the UG's Psychology Ethics Committee. Participants gave informed

consent for participation and personal data collection (SONA ID, age, gender, and study track) before participation.

Upon entering the survey in Qualtrics, participants were randomly assigned to one of three experimental conditions reflecting different levels of social interaction in gardening (see Appendix/Figures A1, A2, and A3). Each condition included a mock newspaper article and corresponding image(s), designed to manipulate the perceived social nature of gardening while maintaining consistent structure and tone across conditions. The control condition was individual gardening - participants read an article about home-based gardening growing in popularity among students at the faculty, emphasizing the individual experience (e.g., “Many students are discovering the personal benefits of cultivating their own plants”). This was accompanied by two photos, one male and one female student gardening alone. Condition 1 was non-interactive community gardening - participants read an article about community gardening at the faculty's garden but with no emphasis on social interaction (e.g., “Students have access to a community garden where they can grow their own fruits, vegetables, and herbs”). This was accompanied by two photos, one male and one female student gardening individually in the shared space. Finally, condition 2 was socially interactive community gardening - participants read an article emphasizing the shared experience of community gardening at the faculty’s garden, highlighting features like picnic benches and social events (e.g., “The community also hosts social events in the garden”). This was accompanied by one photo showing two male and two female students gardening together while smiling and chatting.

After confirming they had read the article, participants completed a series of questionnaires assessing Pro-environmental social identity (PESI) on a faculty level, specifically community pro-environmental norms, community identification, and collective efficacy, as well as individual and collective pro-environmental behavior (PEB) intentions. A

series of manipulation checks were included to assess perceptions of the social interactivity of gardening at the faculty. Next, participants answered questions on their relationship to the faculty community garden (awareness, membership, knowing a member). Finally, demographics (age, gender, psychology track) were collected[1].

To maintain the integrity of the experimental design, participants were not fully informed of the study's purpose or the presence of different experimental conditions before participation. The study was therefore advertised as research "seeking to understand how students engage with gardening activities at the UG", to allow for natural responses (see Appendix). Participants were fully debriefed upon completing the questionnaire and asked to re-consent for participation and personal data collection after they had been fully informed of the study's true purpose.

3.2. Participants

A total of 174 students completed the study. However, 3 participants failed both attention checks and were therefore excluded from all analyses, resulting in a final sample size of $N = 171$. An a priori power analysis using G*Power 3.1 (Faul et al., 2009) for a one-way ANOVA with three groups indicated that a minimum sample size of $n = 159$ was required to detect a medium effect size of $f = 0.25$ with $\alpha = .05$ and power = 0.80 (Kilfeather, 2021). Therefore, the sample size was sufficient. The majority of participants identified as female ($n = 130$), while $n = 38$ identified as male. Two participants selected other, and one preferred not to disclose their gender. Participants were on average 19.92 years old ($SD = 1.74$). Regarding academic track, 64.9% were enrolled in the Dutch-taught track and 35.1% in the English-taught international track. 22.8% reported currently engaging in individual gardening. 28.7% reported being aware of the faculty community garden, and only one

[1] Connectedness to Nature (Schultz, 2002), Environmental Self-identity (van der Werff et al., 2013), Environmentalist Identity (Postmes et al., 2013), and individual gardening activity were also assessed for exploratory purposes.

participant reported personally knowing a member of the community garden. No participants were members themselves.

3.3. Measures

All measures used validated scales unless otherwise specified. Responses were recorded on 7-point Likert scales (either 1 = strongly disagree to 7 = strongly agree, or 1 = very unlikely to 7 = very likely), unless noted. All adaptations kept the original tone and used similar wording to the original scales. Scale correlations and Reliability coefficients are reported in Table 1.

Perceived Community Pro-environmental Norms

Community pro-environmental norms were measured using an adapted version of the 6-item scale from Masson & Fritsche (2014) and assessed students' perceived environmental norms at their faculty (example item: "Students at my faculty try to behave in environmentally friendly ways").

Community Identification

Community identification was measured using an adaptation of the 4-item scale from Postmes et al. (2013) and assessed students' identification with their faculty (example Item: "Being a student at my faculty is an important part of how I see myself").

Collective Efficacy

Collective efficacy was measured using an adaptation of a 4-item scale from Hamann et al. (2024) and assessed students' efficacy beliefs about their faculty reducing negative environmental impacts (example Item: "Students at my faculty are capable of collaborating to solve challenges that arise when addressing environmental problems").

Individual Pro-Environmental Behavior Intentions

On an individual level, PEB intentions were measured using a 5-item scale by Sugiarto et al. (2022), where students answered how likely they were, in the next 6 months, to e.g., “Make an effort to live in a more environmentally friendly way”.

Collective Pro-Environmental Behavior Intentions

On a collective level, PEB intentions were measured using an adapted version of a 7-item scale developed by van Zomeren et al. (2004), where students answered how likely they were, in the next 6 months, to e.g., “Join a group who’s main aim is to preserve or protect the environment“. The measure included two faculty-specific items: (How likely are you to) “Influence the students at your faculty to be more sustainable” and “Garden at the faculty community garden”.

Finally, demographic information (age, gender, study track) was collected.

Table 1

Correlations and Reliability Coefficients of Key Variables

Scale	1.	2.	3.	4.	5.	α
1. Community Pro-environmental Norms	-					.74
2. Community Identification	.30*	-				.77
3. Collective Efficacy	.38*	.41*	-			.81
4. Individual PEB	.35*	.39*	.36*	-		.77
5. Collective PEB	.30*	.26*	.14	.49*	-	.87

Note. $p < .001$*.

Two attention check items were included to ensure data quality (e.g., “This is an attention-check, please select somewhat disagree’’). Additionally, manipulation checks were administered to assess participants' perception of the article’s intended message on 7-point

Likert scales: they were asked to rate how socially interactive they perceived gardening activity to be among students at the faculty, based on the university newspaper article they had read (1 = very individual to 7 = very social), as well as indicate the extent (1 = strongly disagree to 7 = strongly agree) to which they agreed with 4 statements about the article (example item: "More and more students at the Faculty of Behavioral and Social Sciences are gardening in the community garden").

3.4. Data analysis

All data were analyzed using SPSS. The effect of the gardening condition on PESI (in terms of community pro-environmental norms, community identification, and collective efficacy) and (individual and collective) PEB intentions was examined using Multivariate Analysis of Variance (MANOVA) with 3 levels, with Univariate results reported. To examine the relationship between PESI components and (individual and collective) PEB intentions, correlation tables were used. To test whether PESI mediates the relationship between the experimental conditions and PEB intentions, Hayes' (2022) PROCESS macro (model 4) was used.

4. Results

4.1. Preliminary analysis

Participants were randomly assigned to one of three conditions: individual (n = 55), non-interactive (n = 58), or socially interactive (n = 58). One-way ANOVAs on manipulation check items showed significantly higher ratings across conditions in the intended order (ps < .001), confirming the manipulation functioned as intended. Assumptions of normality were assessed using Shapiro-Wilk tests for all dependent variables across the three experimental conditions. Statistically significant deviations were observed for four variables (see

Appendix/Table A1). Boxplots and z-scores were used to locate extreme outliers. Visually, 14 outliers were identified. Based on the conventional threshold of $z > \pm 3.29$ (Tabachnick & Fidell, 2013), one outlier was classified as extreme ($z = -3.51$ on community identification and $z = -3.46$ on individual PEB, non-interactive condition). Excluding the outliers improved normality scores slightly (see Appendix/Table A2). Despite the violations, I chose to retain the outliers to preserve ecological validity and statistical power, as excluding them would have reduced the final sample size below the preregistered threshold ($n = 157$). Given the robustness of ANOVA to minor deviations from normality (especially with balanced groups), I chose to proceed with analyses; however, results should be interpreted with caution. Table 2 presents the means and standard deviations for all dependent variables by condition. Overall, mean scores on the PESI components and pro-environmental behavior (PEB) variables were relatively similar across conditions, with slightly higher individual PEB observed in the social interaction condition.

4.2. The Effect of Gardening Conditions on PESI Components

To test whether gardening conditions affected PESI in terms of community pro-environmental norms, community identification, and collective efficacy (H1), a one-way MANOVA was conducted. In contrast to our predictions, the results revealed no significant multivariate effect of gardening conditions on PESI. Follow-up univariate ANOVAs also indicated that gardening conditions had no significant effect on PESI components. These findings don’t support H1. Results are presented in Table 2.

Table 2

Summary of Means, Standard Deviations, and Univariate Results for PESI and PEB

Variable	Mean (SD)			F(2, 119)	*p*	η^2
	Condition					
	Individual	Non-interactive	Socially interactive			
Pro-environmental Norms	4.22 (.81)	4.25 (.59)	4.29 (.72)	0.15	.87	.00
Community Identification	4.82 (.84)	4.83 (.94)	4.80 (.85)	0.02	.98	.00
Collective Efficacy	4.90 (0.75)	4.94 (.87)	4.80 (.80)	0.50	.61	.01
Individual PEB	4.51 (1.07)	4.44 (.97)	4.78 (.89)	1.91	.15	.02
Collective PEB	2.97 (1.17)	2.83 (.96)	3.07 (.98)	0.81	.45	.01

Note. PEB intentions were included as an exploratory addition.

4.3. The Relationship Between PESI and PEB Intentions

To examine the associations between PESI and individual and collective PEB intentions (H2), bivariate Pearson correlations were conducted (see Table 1). All three PESI components were significantly and positively correlated with individual PEB intentions ($p < .001$), supporting H2a. PESI also showed positive tendencies with collective PEB; however, its correlation with collective efficacy did not reach significance ($p = .08$). The strongest association was found between community identification and individual PEB ($r = .39$). These results partially support H2, suggesting a meaningful positive relationship between PESI and both individual and collective PEB intentions.

4.4. PESI as a Mediator Between Gardening Condition and PEB Intentions

Although the analyses were preregistered to test for a mediation effect of PESI components (H3), the absence of significant effects of gardening condition on PESI (i.e., *a* paths) indicated that mediation was not possible. Nevertheless, the model was examined to

investigate the unique contributions of each PESI component to PEB intentions (i.e., *b* paths) to provide further insight into their significant relationship, as well as the direct effects of gardening condition on PEB intentions when controlling for PESI (i.e., *c'* paths), to examine whether gardening condition affected PEB independently of PESI. Analyses were conducted using PROCESS macro, Model 4 (Hayes, 2022; Kilfeather, 2021), without requiring a significant total effect prior to testing (Hayes, 2009). All analyses used 5000 bootstrap samples to estimate 95% CI, to help account for non-normality in the sampling distribution (Hayes, 2009). The model included gardening condition as the independent variable (X), individual and collective PEB intentions as the dependent variables (Y), and PESI components as mediators (M). The independent variable (gardening condition; X_1 = individual vs. non-interactive, X_2 = non-interactive vs. socially interactive) was dummy-coded. Full results are visualized in Figure 1 for individual PEB intentions and Figure 2 for collective PEB intentions.

When controlling for gardening condition, both perceived community pro-environmental norms and community identification significantly predicted individual (see Figure 1) and collective (see Figure 2) PEB intentions (*b* paths, *ps* < .05). Collective efficacy significantly predicted individual, but not collective, PEB intentions ($p = .01$ and $p = .78$, respectively). Concerning the direct effects (*c'* paths), the socially interactive condition (X_2) showed significantly higher individual PEB intentions ($c' = 0.37$, $p = .02$) compared to the non-interactive condition, indicating that social interaction cues may increase individual behavioral intentions through pathways not captured by PESI. These findings suggest that although mediation was not supported, PESI components uniquely accounted for variance in PEB intentions and may have suppressed direct effects of gardening condition on individual PEB.

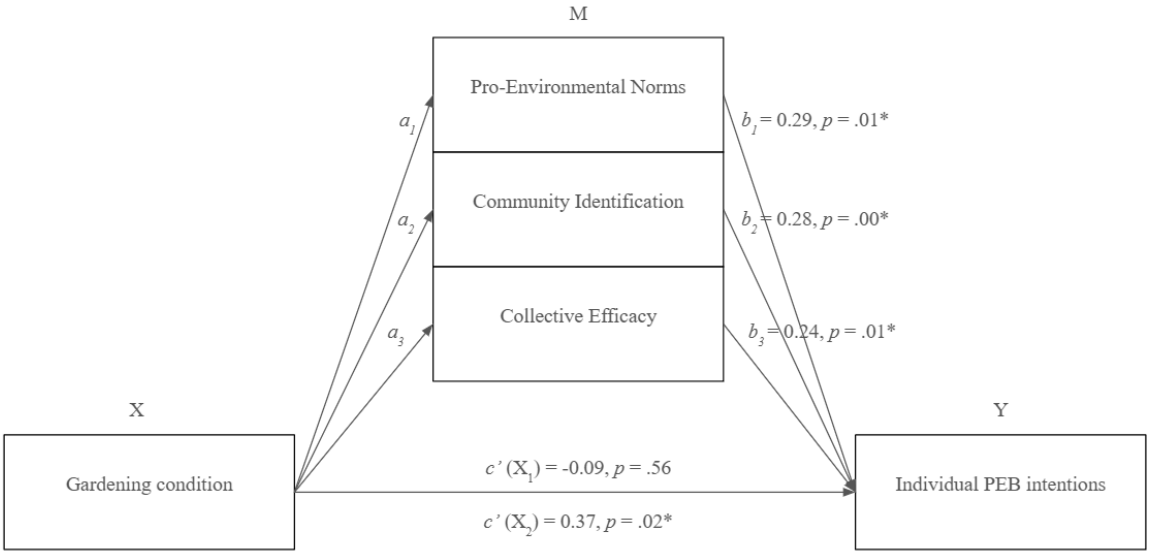

Figure 1. *Summary of Direct Effects of Gardening Conditions and Unique Effects of PESI Components on Individual PEB Intentions*

Note. $p >$ .05*. *a* path results are not shown due to non-significant prior tests.

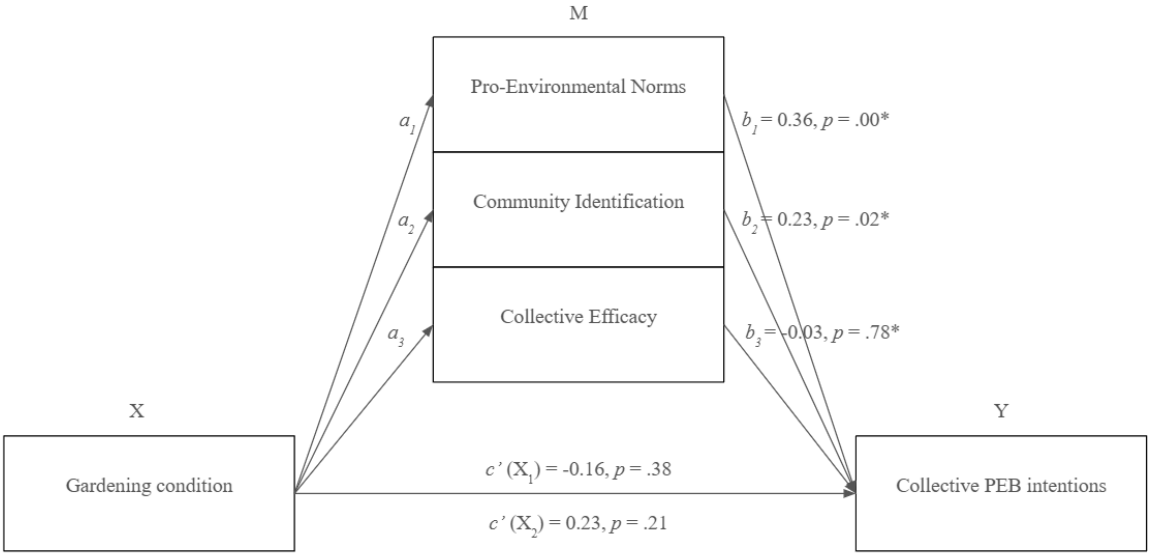

Figure 2. *Summary of Direct Effects of Gardening Conditions and Unique Effects of PESI Components on Collective PEB Intentions*

Note. $p >$ .05*. *a* path results are not shown due to non-significant prior tests.

4.5. Exploratory analyses

Factor Structure of Collective PEB Items

Given the overall weaker results for collective PEB, I examined whether the two faculty-specific items within the scale reflected a distinct dimension from the others. A factor analysis performed with varimax rotation showed all items loading >.70 on the same factor. This indicates that collective PEB intentions were unidimensional, so no follow-up analyses were conducted.

Participants Without Prior Awareness

Participants who were already aware of the garden may hold pre-existing attitudes or associations that could dilute the influence of the manipulation. Preliminary analyses showed no significant differences in PESI or PEB scores between participants who were aware of the community garden and those who were not (*ps* > .05). However, to better isolate the unique effect of the manipulation, I chose to conduct follow-up analyses using only unaware participants (n = 122). A post hoc power analysis indicated that the achieved power would be 0.68. Regarding the univariate results (see Appendix/Table A3), a non-significant marginal trend was observed for collective efficacy (p = .09). Mean scores were highest in the non-interactive gardening condition (M = 5.07), followed by the individual (M = 4.90), and lowest in the socially interactive condition (M = 4.67). Planned contrasts revealed that collective efficacy scores in the socially interactive condition were significantly lower than in the non-interactive condition ($F(1, 119) = 4.86$, $p = .03$, $\eta^2 = .04$). These findings suggest that for unaware participants, social interaction cues may have disturbed the formation of PESI (especially collective efficacy).

5. Discussion

The experimental study investigated how observing varying levels of social interaction in gardening (individual, non-interactive, and socially interactive gardening) influenced pro-environmental social identity formation (PESI; in terms of pro-environmental community norms, community identity, and collective efficacy), and pro-environmental behavior (PEB) intentions among university students who are not participating in community gardening at their faculty. Three preregistered hypotheses were tested: H1 predicted that gardening conditions would influence the PESI, with non-interactive gardening resulting in higher PESI scores than individual gardening (H1a) and socially interactive gardening resulting in higher PESI scores than non-interactive gardening. H2 predicted that higher scores on PESI components would relate to stronger PEB intentions, both individually (H2a) and collectively (H2b). H3 predicted that any effect of gardening conditions on individual (H3a) and collective (H3b) PEB intentions would be mediated by PESI. In addition, exploratory follow-up analyses were conducted using a subsample of only participants without prior awareness of the faculty community garden.

The data did not show support for H1; none of the PESI components significantly differed across the experimental conditions. H2 was partially supported; PESI components correlated positively with both PEB intentions, but the link between collective PEB intentions and collective efficacy didn't reach significance. Due to the absence of the effect of experiential conditions on PESI, H3 was not supported: There were no indirect effects of experimental conditions on PEB intentions through PESI. Instead, the unique effects of PESI components on PEB intentions and the direct effects of gardening conditions on PEB intentions were examined. Community pro-environmental norms and community identification showed significant unique effects on both individual and collective PEB, and collective efficacy showed a significant unique effect on individual PEB, but not collective

PEB. Furthermore, a significantly positive direct effect emerged on individual PEB in the socially interactive compared to the non-interactive condition when holding PESI constant. Exploratory follow-ups revealed that among participants who had no prior awareness of the faculty community garden, there was an unexpected dip in collective efficacy in the socially interactive compared to the non-interactive condition.

5.1. Interpretation and Comparison with Past Literature

In line with theoretical expectations (Fritsche et al., 2018; Postmes et al., 2005), all three PESI components were positively associated with individual PEB intentions. Notably, in the mediation model, each component accounted for unique variance in individual PEB, with community norms and identification also predicting collective PEB. Interestingly, collective efficacy predicted individual but not collective PEB intentions when controlling for the other components, indicating that the belief in collective agency may enhance personal engagement in sustainable behaviors more than it mobilizes participation in group-level actions. This is somewhat unexpected given prior literature emphasizing its importance for collective mobilization (Fritsche et al., 2018), and may reflect sample-specific dynamics, such as a low baseline willingness to act collectively or a lack of perceived access to such opportunities.

Moreover, when PESI components were held constant, individual PEB intentions significantly increased in the socially interactive compared to the non-interactive condition. This suggests that PEB intentions can be triggered through alternative pathways not captured by PESI. Notably, this pattern seems to contradict the classic social identity hypothesis that pro-environmental group identity enhances behavioral intent (Fritsche et al., 2018; Postmes, 2005); instead, PESI appeared to suppress a direct effect on behavioral intentions. Affective or observational mechanisms such as modeling (Bandura, 1977) or emotional contagion

(Hatfield et al., 2011) may provide alternative explanations for how socially embedded behavior influences observers without necessarily eliciting group identification. Unlike PESI, which involves the cognitive and motivational processes of identifying with a group and internalizing its environmental values and goals (Fritsche et al., 2018), these mechanisms rely on more immediate, often unconscious responses to observed behavior or group affect. Specifically, witnessing others engage in pro-environmental behavior together may evoke an automatic urge to imitate or emotionally resonate with the group's mood. Affect-driven processes may serve as an alternative route to action when social identity formation fails, especially in short or passive exposures where identification may not have sufficient time or context to develop.

Another theoretical possibility is that all gardening conditions, regardless of their level of social interaction, may have had a baseline elevating effect on PESI. Because the study did not include a truly neutral, non-environmental control condition, it is unclear whether simply being exposed to any gardening-related content may have primed environmental identity or values. This raises the question of whether the absence of significant differences between conditions reflects a true null effect or a ceiling effect in which all groups experienced a mild boost in PESI relative to a non-gardening baseline. Including a non-environmental control group would allow researchers to isolate the specific contribution of gardening and of social interaction within it, to PESI components and behavioral outcomes.

Overall, the findings did not provide support for PESI formation through observation of social interaction alone. Importantly, manipulation checks confirmed that participants perceived varying levels of social interaction across conditions, indicating that the lack of significant effects was not likely due to a failed manipulation. A previous thesis by Kilfeather (2021) found that only collective efficacy mediated the relationship between participating in

community gardening and individual PEB, which is why I would have expected it to have the strongest positive effect of all PESI components from observation as well (Van Mourik Broekman, 2018). Contrary to expectations, PESI scores were not higher in the socially interactive gardening condition. In fact, a consistent negative trend emerged, particularly among participants who were previously unaware of the community garden. Collective efficacy was the most affected PESI component, showing a marginally significant decline. However, it is important to acknowledge that the trend was not significant and therefore should be interpreted with caution.

This effect may be pursued in future studies, because it raises important theoretical questions. One possibility is that components like community identification and collective efficacy were interpreted negatively, especially if the group appeared exclusive or inaccessible. In such cases, lower PESI scores may reflect psychological distancing, which could counteract the motivational potential of witnessing pro-environmental behavior. The negative trend is also at odds with prior research suggesting that observing social cohesion can foster vicarious group belonging (Van Mourik Broekman, 2018; Jans et al., 2023). In the current study, however, observing social interaction in community gardens may have signaled exclusion rather than inclusion. For instance, the use of the word "community" in the stimulus article (without a clear invitation for participation) may have contributed to perceiving the group as secluded. Literature suggests that perceived outgroup dynamics can elicit detachment or defensive distancing (Hewstone et al., 2002; Tajfel & Turner, 1979). Representation in the photographs (e.g., gender ratio) may also have played a role, especially given the predominantly female participant sample. These nuances challenge the assumption that mere exposure to communal social action is sufficient for social identity formation.

In sum, while PESI remains a valuable pathway for mobilizing pro-environmental behavior, its formation through passive observation appears highly context-dependent. These

findings underscore the importance of further examining the threshold where social identity processes emerge to influence sustainable action.

5.2. Limitations and Future Research Directions

Several limitations should be acknowledged when interpreting the present findings. First, the study used static photographs and brief texts to represent the gardening conditions. Although these were carefully designed to reflect realistic community garden scenarios, they may not have been immersive enough to elicit the psychological processes involved in identity formation. Future research could benefit from using more engaging materials, such as narrated videos or dynamic visuals, or involving observers in imagined social interactions (e.g., using VR; see Plechatá, 2025) to test their role more directly. Furthermore, the socially interactive gardening condition may have unintentionally signaled exclusivity or was simply not relateable to participants, particularly those unfamiliar with the garden. Although the stimuli were designed to portray inclusivity, participants may have perceived the group as closed or irrelevant to their context. Future work should therefore directly assess perceived group openness and representativeness to better understand how these social cues influence identification.

Second, the study did not further explore the role of important covariates such as connectedness to nature and personal gardening behavior, despite having measured them. These variables have been identified in prior literature as strong predictors of pro-environmental behavior. Connectedness to nature, as in the degree to which individuals include nature in their sense of self (Schultz, 2002) has been shown to mediate the link between gardening and PEB (Kilfeather, 2021), while personal gardening has been found to promote environmental awareness and daily sustainable practices (Turner, 2011). Not

accounting for these variables in the main analyses may have masked meaningful effects, and future research should aim to include them as covariates or moderators.

Third, the exploratory subgroup analysis among participants unaware of the community garden was underpowered, with a post hoc power estimate of only 0.68 for detecting a medium effect. While these findings yielded intriguing negative patterns (particularly regarding collective efficacy), they should be interpreted cautiously and validated in larger samples.

Fourth, several PESI-related scales showed minor normality violations, which may have affected the precision of some parametric tests. While the MANOVA procedure is relatively robust to moderate violations, future studies may benefit from using transformations or bootstrapped confidence intervals for added precision.

Finally, the absence of a truly neutral, non-environmental control condition limited the ability to disentangle the effects of gardening exposure from general sustainability cues. Including such a condition in future research would help isolate the unique effects of the gardening scenarios.

Together, these limitations suggest that future work should refine both methodological and theoretical approaches to better capture the complex pathways through which community gardening may influence pro-environmental identity and behavior.

Conclusion

Climate change is a fundamentally collective issue requiring broad societal engagement and coordinated action. Small-scale, sustainable collectives such as community gardens have the potential to serve as valuable sites for both individual and collective pro-environmental engagement. However, to meaningfully scale their impact, it is essential to understand not only how they benefit direct members but also how they influence the

surrounding community. Further investigating the indirect mechanisms by which such initiatives foster wider change is crucial for informing the development of more effective, socially grounded sustainability interventions.

This thesis aimed to contribute to that understanding by examining whether observing social interaction within community gardening could foster pro-environmental social identity and increase behavioral intentions among non-participants in the broader (university) community. While PESI formation through observation alone appears limited, socially interactive gardening cues did increase individual behavioral intentions. This highlights the complexity of the psychological pathways through which community gardens can exert influence, and the need to consider both identity-based and non-identity-based mechanisms, such as affective engagement or observational learning. The findings carry practical implications for similar sustainable grassroots initiatives and their broader communities: while showcasing community engagement may appear to promote identification, it also risks signaling exclusivity if not communicated effectively.

While further research is necessary to clarify the underlying conditions and necessary mechanisms, the present study offers preliminary evidence that socially interactive community gardens may serve as catalysts for fostering more environmentally engaged societies. Yet, their success in doing so depends not only on visible community engagement but on how it is interpreted by the target audience.

References

Bandura, A., & Walters, R. H. (1977). *Social learning theory* (Vol. 1, pp. 141-154). Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman and Company.

Bashir, N. Y., Lockwood, P., Chasteen, A. L., Nadolny, D., & Noyes, I. (2013). The ironic impact of activists: Negative stereotypes reduce social change influence. *European Journal of Social Psychology, 43*(7), 614-626. https://doi.org/10.1002/ejsp.1983

Bouman, T., Steg, L., & Dietz, T. (2021). Insights from early COVID-19 responses about promoting sustainable action. *Nature Sustainability*, 4(3), 194-200. https://doi.org/10.1038/s41893-020-00626-x

Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A Focus Theory of Normative Conduct: A Theoretical Refinement and Reevaluation of the Role of Norms in Human Behavior. *Advances in Experimental Social Psychology Volume 24*, 201-234. https://doi.org/10.1016/S0065-2601(08)60330-5

Clarke, L. W., Li, L., & Jenerette, G. D. (2019). The underutilized role of community gardens in improving cities' adaptation to climate change: A review. *People and Nature*, 1(3), 243-256. https://doi.org/10.1002/pan3.10058

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149-1160. http://dx.doi.org/10.3758/BRM.41.4.1149

Firth, C., Maye, D., & Pearson, D. (2011). Developing "community" in community gardens. *Local Environment*, 16(6), 555-568. https://doi.org/10.1080/13549839.2011.586025

Fritsche, I., Barth, M., Jugert, P., Masson, T., & Reese, G. (2018). A social identity model of pro-environmental action (SIMPEA). *Psychological Review*, 125(2), 245-269. https://doi.org/10.1037/rev0000090

Guazzini, A., Valdrighi, G., Fiorenza, M., & Duradoni, M. (2025). The relationship between connectedness to nature and pro-environmental behaviors: A systematic review. *Sustainability, 17*(8), 3686. https://doi.org/10.3390/su17083686

Hamann, K. R., Wullenkord, M. C., Reese, G., & Van Zomeren, M. (2024). Believing that we can change our world for the better: A Triple-A (Agent-Action-Aim) Framework of self-efficacy beliefs in the context of collective social and ecological aims. *Personality and Social Psychology Review, 28*(1), 11-53. https://doi.org/10.1177/10888683231178056

Hatfield, E., Rapson, R. L., & Le, Y. C. L. (2011). Emotional contagion and empathy. *J., Decety, W. Ickes,(Eds.), The social neuroscience of empathy*, 19-30.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Communication Monographs*, *76*(4), 408-420. https://doi.org/10.1080/03637750903310360

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (3rd ed.). The Guilford Press.

Hewstone, M., Rubin, M., & Willis, H. (2002). Intergroup bias. *Annual Review of Psychology, 53*(1), 575–604. https://doi.org/10.1146/annurev.psych.53.100901.135109

Ivanova, D., Barrett, J., Wiedenhofer, D., Macura, B., Callaghan, M., & Creutzig, F. (2020). Quantifying the potential for climate change mitigation of consumption options. *Environmental Research Letters*, *15*(9), 093001. https://doi.org/10.1088/1748-9326/ab8589

Ives, C. D., Freeth, R., & Fischer, J. (2018). Inside-out sustainability: The neglect of inner worlds. *Ambio*, 47(7), 768-775. https://doi.org/10.1007/s13280-018-1011-3

Jans, L. (2021). Changing environmental behaviour from the bottom up: The formation of pro-environmental social identities. *Journal of Environmental Psychology*, 73, 101552. https://doi.org/10.1016/j.jenvp.2021.101552

Jans, L., Koudenburg, N., & Grosse, L. (2023). Cooking a pro-veg*n social identity: The influence of vegan cooking workshops on children's pro-veg*n social identities, attitudes, and dietary intentions. *Environmental Education Research, 29*(9),

1361-1376. https://doi.org/10.1080/13504622.2023.2233490

Kilfeather, C. (2021). *Reconnecting societies back with nature and community: Community gardens and pro-environmental community identity formation* (Master's thesis). University of Groningen.

Komatsu, H., Rappleye, J., & Silova, I. (2019). Culture and the Independent Self: Obstacles to environmental sustainability? *Anthropocene, 26,* 100198. https://doi.org/10.1016/j.ancene.2019.100198

Koudenburg, N., Kannegieter, A., Postmes, T., & Kashima, Y. (2020). The subtle spreading of sexist norms. *Group Processes & Intergroup Relations*, 00(0), 1-19. https://doi.org/10.1177/136843022096183

Masson, T., & Fritsche, I. (2014). Adherence to climate change‐related ingroup norms: Do dimensions of group identification matter? *European Journal of Social Psychology, 44*(5), 455-465. https://doi.org/10.1002/ejsp.2036

Masson, T., & Fritsche, I. (2021). Collective climate action: When do people turn into collective environmental agents? *Current Opinion in Psychology, 42*, 114-119. https://doi.org/10.1016/j.copsyc.2021.05.001

Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2008). Normative social influence is underdetected. *Personality and social psychology bulletin*, *34*(7), 913-923. https://doi.org/10.1177/0146167208316691

Plechatá, A., Morton, T., & Makransky, G. (2025). Promoting collective climate action and identification with environmentalists through social interaction and visual feedback in virtual reality. *Journal of Environmental Psychology*, 102526. https://doi.org/10.1016/j.jenvp.2025.102526

Postmes, T., Haslam, S. A., & Swaab, R. I. (2005). Social influence in small groups: An interactive model of social identity formation. *European Review of Social Psychology*, 16(1), 1-42. https://doi.org/10.1080/10463280440000062

Postmes, T., Haslam, S. A., & Jans, L. (2013). A single‐item measure of social identification: Reliability, validity, and utility. British journal of social psychology, 52(4), 597-617. https://doi.org/10.1111/bjso.12006

Schultz, P.W. (2002). Inclusion with Nature: The Psychology Of Human-Nature Relations. In: Schmuck, P., Schultz, W.P. (eds) Psychology of Sustainable Development. Springer, Boston, MA. https://doi.org/10.1007/978-1-4615-0995-0_4

Tabachnick, B. G., & Fidell, L. S. (2013). Using Multivariate Statistics (6th ed.). Boston, *MA: Pearson.*

Tajfel, H., & Turner, J. (1979). An integrative theory of intergroup conflict. In W. G. Austin, & S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33-47). Monterey, CA: Brooks/Cole.

Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J. A., & Litt, J. S. (2009). Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens. *Health & place, 15*(4), 1115-1122. https://doi.org/10.1016/j.healthplace.2009.06.003

Thomas, E. F., McGarty, C., & Mavor, K. (2016). Group interaction as the crucible of social identity formation: A glimpse at the foundations of social identities for collective action. *Group Processes & Intergroup Relations, 19*(2), 137–151. https://doi.org/10.1177/1368430215612217

Turner, B. (2011). Embodied connections: Sustainability, food systems, and community gardens. *Local Environment: The International Journal of Justice and Sustainability, 16*(6), 509-522. https://doi.org/10.1080/13549839.2011.569537

Van der Werff, E., Steg, L., & Keizer, K. (2013). The value of environmental self-identity: The relationship between biospheric values, environmental self-identity and environmental preferences, intentions and behaviour. *Journal of Environmental Psychology*, *34*, 55-63. https://doi.org/10.1016/j.jenvp.2012.12.006

van Mourik Broekman, A., Gordijn, E. H., Koudenburg, N., & Postmes, T. (2018). Reshaping social structure through performances: Emergent solidarity between actors and observers. *Journal of Experimental Social Psychology*, *76*, 19-32. https://doi.org/10.1016/j.jesp.2017.12.002

van Zomeren, M., Spears, R., Fischer, A. H., & Leach, C. W. (2004). Put your money where your mouth is! Explaining collective action tendencies through group-based anger and group efficacy. *Journal of Personality and Social Psychology, 87*(5), 649-664. https://doi.org/10.1037/0022-3514.87.5.649

Appendix

Table A1

Shapiro-Wilk Test of Normality Across Conditions

Variable	Individual (n = 55)	Non-interactive (n = 58)	Socially interactive (n = 58)
Pro-environmental Norms	.97 (p = .16)	.96 (p = .06)	.98 (p = .36)
Community Identification	.96 (p = .09)	.90 (p < .001)*	.98 (p = .52)
Collective Efficacy	.94 (p = .01)*	.94 (p = .01)*	.98 (p = .28)
Individual PEB	.96 (p = .04)*	.92 (p < .001)*	.97 (p = .09)
Collective PEB	.91 (p < .001)*	.94 (p = .01)*	.96 (p = .03)*

Note. Values represent W test statistic. Violations marked "*". Connectedness to nature was excluded from this table as it consisted of a single item.

Table A2

Shapiro-Wilk Test of Normality after Removal of Outliers

Variable	Individual (n = 48)	Non-interactive (n = 55)	Socially interactive (n = 54)
Community Identification	.97 (p = .35)	.92 (p = .001)*	.98 (p = .50)
Collective Efficacy	.95 (p = .03)*	.96 (p = .07)	.96 (p = .08)
Individual PEB	.98 (p = .08)	.93 (p = .004)*	.98 (p = .56)
Collective PEB	.91 (p = .002)*	.94 (p = .01)*	.96 (p = .08)

Note. Values represent W test statistic. Violations marked "*". Green indicates normality. achieved.

Table A3

Summary of Means and Univariate Results of Unaware Participants

Variable	Mean (SD)			F(2, 119)	*p*	η^2
	Condition					
	Individual	Non-interactive	Socially interactive			
Pro-environmental Norms	4.13 (0.85)	4.28 (0.59)	4.19 (0.68)	0.48	.62	0.01
Community Identification	4.83 (0.83)	4.84 (1.01)	4.69 (0.81)	0.34	.71	0.01
Collective Efficacy	4.90 (0.75)	5.07 (0.88)	4.67 (0.76)	2.44	.09	0.04
Individual PEB	4.49 (1.15)	4.50 (0.99)	4.80 (0.93)	1.16	.32	0.02
Collective PEB	2.89 (1.17)	2.80 (0.92)	3.00 (0.97)	0.4	.67	0.01

Home Gardening

A Growing Trend Among Students at the Faculty of Behavioural and Social Sciences

More and more students at the Faculty of Behavioural and Social Sciences are turning to home gardening as a way to unwind and reconnect with nature. Whether tending to a small balcony garden or growing herbs on a windowsill, many students are discovering the personal benefits of cultivating their own plants.

"I never thought I'd enjoy growing my own vegetables at home, but it's actually really rewarding," says Lisa, a third-year student. "Gardening is a great way to take a break from studying while doing something productive," says Tom.

Figure A1. *Individual Gardening Condition*

Community Gardening

A Growing Trend Among Students at the Faculty of Behavioural and Social Sciences

More and more students at the Faculty of Behavioural and Social Sciences are turning to community gardening as a way to unwind and reconnect with nature. At the faculty, students have access to a community garden where they can grow their own fruits, vegetables, and herbs.

"I never thought I'd enjoy growing my own vegetables, but it's actually really rewarding," says Lisa, a third-year student. "Gardening at the community garden is a great way to take a break from studying while doing something productive," says Tom.

Figure A2. *Non-Interactive Gardening Condition*

Gardening Together

A Growing Trend Connecting Students at the Faculty of Behavioural and Social Sciences

More and more students at the Faculty of Behavioural and Social Sciences are turning to community gardening as a way to unwind and reconnect with nature together. At the faculty, students have access to a shared community garden where they can grow their own fruits, vegetables, and herbs together. There are picnic benches for students to connect and interact with each other, and the community also hosts social events in the garden.

"I never thought we would enjoy growing our own vegetables, but it's actually really rewarding," says Lisa, a third-year student. Tom adds, "Gardening as a community is a great way to take a break from studying while doing something productive together."

Figure A3. *Socially Interactive Gardening Condition*