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How Do Human Interaction Labs Contribute to Engineering Leadership Development Growth?

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Mr. Zorman received his M.S. degree in computer science from the University of Technology in Vienna. He worked for 23+ years in the telecom industry in Europe and North America as engineer, leader, mentor, coach and leadership development professional.

After a long and fulfilling customer-facing career, Mr. Zorman decided in 2007 to change his career direction and to focus on leadership development, mentoring and coaching to support engineers on their journey to become effective and successful leaders. He designed and delivered programs in the area of leadership- and team development addressing areas like effective communication, emotional intelligence, conflict resolution, and customer service excellence.

It was during those five years when he realized that supporting young professionals with their leadership development is his life calling. He decided to leave corporate business and accepted a position at Cornell's College of Engineering.

During the last years, Mr. Zorman has focused on the design and implementation of a course using a student-led laboratory method which supports the development of authentic and courageous leaders.

How Do Human Interaction Labs Contribute to Engineering Leadership Development?

Abstract

This paper outlines the impact of a small group experiential learning course (Human Interaction Lab) that cultivates authentic engagement between participants. Unlike many experiential learning environments, this course is fundamentally learner-centered, where students designate both the content of discussion and the norms that dictate behavior. While initiatives to develop leadership skills are ubiquitous, few have demonstrated effectiveness in cultivating mature, authentic interpersonal interaction necessary for relational leadership. In addition, while many theories have attempted to understand leadership, an increasingly popular—and successful--approach to understanding relational leadership development is identity.

Previously published qualitative analysis of participant data from Human Interaction Labs (HILs) has provided insight into personal development and the mechanisms through which participants were impacted and has been previously published. These labs provide a scaffold for cultivating intrapersonal, interpersonal, and group-based competencies by promoting an authentic, holistic, relational framework. The course consists of several separate-- but interdependent—activities, such as group participation, readings, reflection, and a retreat.

The purpose of this practice paper is to further interpret the (previously published) value of HILs, but within a leadership identity framework. Because of their positive impact on identity development, these Labs may hold promise as an environment in which students can develop healthy relational leadership processes. Three identity-based frameworks will be used to interpret the influence of HIL structure and experiences: Leadership Identity Development (LID), self-authorship, and Community of Practice (CoP).

This paper addresses the impact that experiential learning courses can have on leadership identity development. The activities that comprise HILs will be presented. A brief review of the literature will provide context for further identity-based interpretation. With background established, the work will present ways in which HILs impact leadership identity development. Findings paint a broad picture of how HILs develop identity, including the importance of learner-centered structure, a dialogue of reflection and feedback, learning by doing, and a long-term group-based environment . In summary, this research provides a starting point for further qualitative and quantitative exploration of Human Interaction Labs' impact on engineering leadership identity development.

Introduction

For several decades, industry leaders have been pushing for more preparation in professional skills amongst engineering graduates. In particular, leadership has emerged as an important quality in new graduates as they engage with the workforce. This is reflected in current ABET standards and the core goals of the National Academy of Engineering (NAE) Grand Challenges.

Increasingly, higher education institutions are responding to these demands. For example, there is an increasing number of engineering leadership development programs, as well as increasing research in the topic [e.g., 1, 2]. However, there is concern that these leadership programs may

not be contributing to leader development effectively. Moreover, without clear agreement (and metrics) about what constitutes effective engineering leadership, there are limited tools to assess the impact of various approaches.

Fortunately, the challenge of describing leader development (a necessary prerequisite to developing it) has been taken up by the leadership studies literature with increasing interest over the past 15 years. This field has used the complex, individual and staged characteristics of identity to explore those same aspects of leadership development. While identity has proven powerful in describing leader development in this field, identity has not seen widespread application in the engineering leadership literature, let alone its programs.

While early research indicates that engineering leadership development may be well-served by identity-based approaches, the existing literature is only just beginning to explore this topic. Hence, studies that further understanding of engineering leadership identity may improve the ability of university programs to cultivate student leadership effectiveness.

Outline

1. Introduction
2. Identity background
    2.1. Personal
    2.2. Professional
    2.3. Leadership
3. HIL background
    3.1. Activities
    3.2. Objectives
4. Identity & HIL
5. Methodology
6. Findings
    6.1. Overall
    6.2. Intrapersonal
    6.3. Interpersonal
    6.4. Group
    6.5. Summary
    6.6. Limitations
7. Conclusion

Identity

Identity is a diffuse concept with many definitions; it will here be defined as "how persons position themselves and are positioned by society" [3]. While a full exploration of identity is outside the scope of this discussion, it is worth noting that Erik Erikson's [4] seminal 8-staged theory was the first to explicitly create a psychosocial perspective [5]. This perspective focused on individuals' self-view and their relationship with society; it has also provided the foundation for subsequent development of identity in the literature [6].

While the interdependent characteristic of identity--where aspects of one's identity grow relatively in concert with one another [7]—lend it to a broad range of fields, this paper will focus on three particularly relevant aspects of identity: personal, professional, and leadership (Figure 1). Personal identity-- as outlined by self-authorship [9][8][11]-- describes how an individual makes sense of the world around them. Professional identity focuses on how one sees oneself in technical and interpersonal aspects of their work [10]. Finally, leadership identity—as defined by Leadership Identity Development (LID) [11]-- outlines how individuals come to see themselves as leaders, based on experience, self-efficacy, feedback, and values [12, 13]. In sum, a psychosocial approach of professional and leadership identity, combined with core concepts relevant during college-age personal identity development, provide context for the path taken by this paper.

The use of identity as a framework has several characteristics that are particularly valuable to understand college student development. First, identity provides a lens for understanding the complexities and personal nature of student development [14]. Development is complex, moving forward several steps, then stabilizing in times of integration; it is also personal, as students develop along varied dimensions. Second, identity provides a framework for dealing with dynamic staged processes, such as are encountered during the transformative experiences that typically characterize the undergraduate journey. Third, identity provides insight into motivation, making it a useful construct for understanding retention. The cumulative effect of these characteristics suggest that identity is an effective framework for understanding student education. In fact, the case has been made that engineering education is— by definition— engineering identity formation [15].

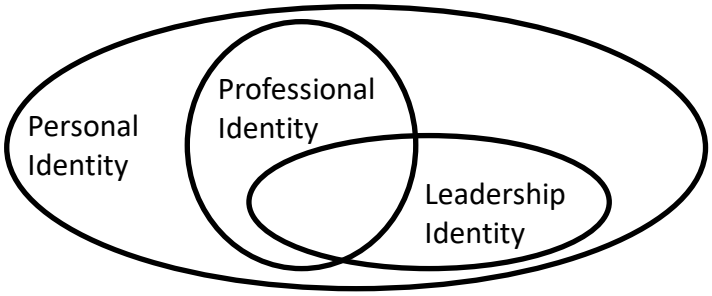

Figure 1: Relationship between identity components

Personal Identity

Possibly the most important concept to college students in the realm of personal identity is self-authorship. Self-authorship describes the ability of an individual to create their own knowledge and to reflectively engage with others. It is critical to students' development as it reflects their psychological differentiation from co- constructors of childhood, as they begin to distinguish ideas grounded on the internal self from those grounded on others' influence [16]. Self-authorship characterizes moving from externally derived meaning making structures, to internally controlled ones, as detailed by Baxter Magolda [16]. Her work emerged out of Kegan's 6-staged theory of development, which focused on one's locus of control [8].

Research has found that several experiences are particularly effective at developing self-authorship [17]: self-authorship grew when students were expected to create their own views and take responsibility for them (p. 878); self-authorship also grew when critical approaches were

scaffolded in class concurrent with guidance and support from supportive faculty and peers (p. 879). In summary, self-authorship is a central component of college student development, and it can be cultivated by giving students responsibility, scaffolding, and support as they exercise autonomous and critical behaviors.

Professional Identity

Lave and Wenger's [18] Community of Practice (CoP) model outlines a framework for understanding professional identity. This model is based on trade apprenticeship, consisting of a central community of experts surrounded by members exhibiting various levels of engagement. In this community, recognition by others (in terms of practice and values) is the way one moves into more central roles in the community. Newcomers to the community increase their own sense of belonging in the group through three modes: imagination (i.e., how can I see myself as a member?), engagement (i.e., how can I participate in this community?), and alignment (i.e., how do my values align with this community's?) [19]. This theory suggests that increased sense of communal belonging is important to increased professional identity. Moreover, this approach highlights the importance of how novice practitioners develop by taking initiative and responsibility to forge their own path of growth; this theory therefore foregrounds self-authorship as a central component of professional identity development. Finally, Lave's [18] and Wenger's [19] early works include compelling critiques of existing university practices and how they create barriers for healthy professional identity development. Proposed solutions are rooted in the three modes of belonging: engaging in meaningful work with responsibility, imagining oneself as an engineer (often through reflection or exploration) and aligning one's values and behaviors with those of the profession [19].

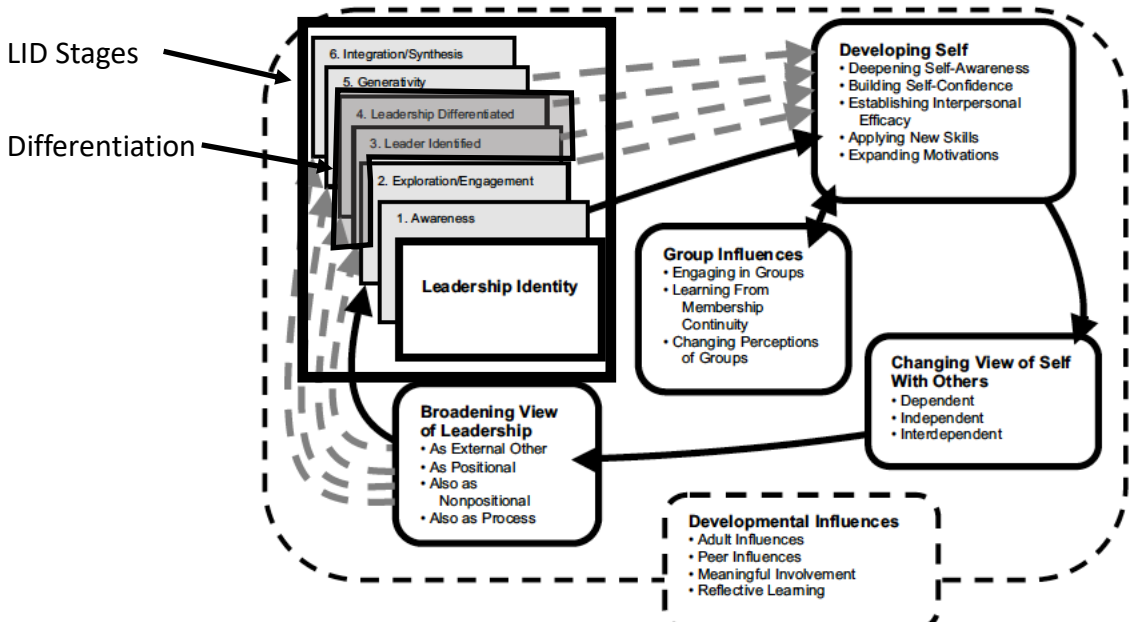

Figure 2: Leadership Identity Development Developmental Sources [23]

Leadership Identity

This paper will use the Leadership Identity Development (LID) model to address leadership development processes and mechanisms [11, 21]. This model argues that six stages describe a

progression of simple awareness of positional leaders to incorporating relational leadership processes into one's identity. Within this model, typical college students are transitioning from a positional to a relational view of leadership through a process called Differentiation [22]. During this process, students learn that leadership is not necessarily bound to position or authority.

Development along these six stages is cultivated and influenced by five categories of experiences: *Developmental Influences, Developing Self, Group Influence, Changing View of Self with Others*, and *Broadening View of Leadership* (Figure 2).

1. *Developmental Influences* impact students broadly, often in dynamic ways (e.g., adults first recognize potential and later functioned as meaning-makers).
2. *Developing Self* characterize experiences that effect personal growth, expressed through five sub-categories, per Figure 1.
3. *Group Influence* includes interactions that are group based, such as engagement (e.g., increased clarity regarding their commitment to a group through engagement experiences), learning from membership continuity (i.e., gaining increased insight through seeing group change over time), and changing perceptions of the group (i.e., understanding how the group engages with external agents with increasing clarity). Group recognition and feedback are important mechanisms for assessing leadership behavior effectiveness.
4. *Changing View of Self* captures the development of students from being dependent on others to being independent from others to being interdependent with others.
5. *Broadening View of Leadership* captured aspects of development pertaining to more expansive thinking about leadership. Students who integrate a stable view of leadership into their identity are able to see the leadership process in groups and how individuals engage meaningfully with that process.

In summary, these five categories communicate essential experiences through which leadership identity develops and shifts. It is worth noting that these categories are involved in the growth of individuals at all stages of the LID model, but the ways in which they interact and express student experience is complex and variable, reflecting the dynamic nature of identity development [11].

One prominent literature stream on engineering leadership identity is emerging from University of Toronto's Troost ILead. Their qualitative exploration of 61 Canadian professional engineers found that engineering leaders expressed themselves along three orientations [20]. These engineers shared their well-developed technical problem-solving skills with others through informal mentorship—*technical mastery*; they built effective and efficient teams across organizational units by learning about and leveraging their colleagues' strengths—*collaborative optimization*; and they used entrepreneurial thinking to bring technically sound ideas to market—*organizational innovation.* In summary, these orientations reflect how leadership is expressed in the engineering profession. More, they illustrate both the varied ways in which individuals engage with others, as well as the diverse goals towards which these leadership behaviors work.

Identity Summary

In summary, identity approaches provide a framework for understanding student development across three core domains: personal, professional, and leadership. Self-authorship is an essential process in personal identity development during the college years. The CoP model outlines ways

in which belonging is essential to professional identity. The LID model outlines processes typical of relational leadership development. In sum, identity frameworks provide insight into the types of experiences and environments that lead to complex development.

Human Interaction Labs

The Human Interaction Lab (HIL) is a program that revolves around weekly T-groups, with cohorts of approximately 12 people. Charles Seashore describes T-Groups as a *"…type of experience-based learning where participants work together in a small group over an extended period of time, and learn through analysis of their own experiences, including emotions, reactions, perceptions, and behavior*" [36]. Further practices and characteristics may be explored in more detail in the literature [31]–[35].

While experiential education covers a broad range of pedagogies, the T-Group approach is distinct in several ways. The major differences between the T-Group method and other experience-based learning models are described by Chris Argyris as follows [37]:

- There is no agenda, except as the group provides it.
- There are no norms of group operations.
- For some time, the experience is confusing, tension-laden, and frustrating for most participants.
- The educator doesn't provide the leadership that a group of students would normally expect and stays quiet most of the time, except for occasional interventions.

The objectives and design of HILs (as well as research on the effectiveness) are described in detail in the HIL literature [31]–[35], [48], [51]–[53]. Unlike conventional HILs which are usually offered as intensive multi-day seminars, the HIL which is used as the basis for this paper is a semester-long leadership course for undergraduate students at a liberal arts STEM college in the US which is similar to the course "Interpersonal Dynamics" offered at the Stanford Graduate School of Business [38].

HIL Activities

The HIL structure operationalized here consists of six core activities: T-groups, Reflective Assignments, Learning Partners, Readings, Learning Goals, and a Final Weekend Retreat. Reflective Assignments provide participants to explore their emotional and cognitive reactions during T-groups, with feedback offered by the facilitator. Learning Partners are peers who can

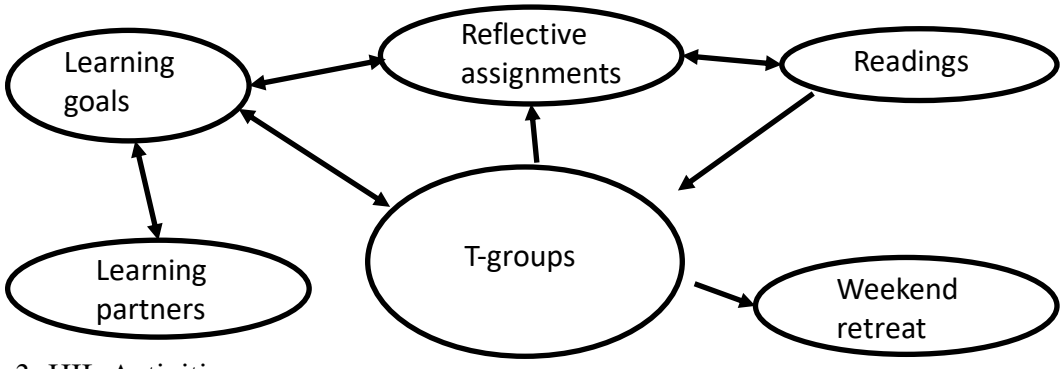

Figure 3: HIL Activities

provide honest feedback and support in a relatively safe context. Readings inform the types of experiences that typify the T-group experience. Learning Goals are objectives that individuals set to support their own growth. Finally, the Weekend Retreat is a culminating experience for participants to reflect, appreciate one another, and interpret the entire experience.

HIL Objectives

Finally, the objectives of this HIL-based course are to support development along three Levels of Analysis: intrapersonal skills, interpersonal skills, and group culture (Figure 4). These domains reflect the distinct, but connected, ways students experience and grow during their participation. They use reflective self-awareness to guide increasingly authentic engagement with others. This process leads to the creation of a group culture that provides psychological safety and meaningful engagement.

In regards to *intrapersonal* skill development, the objectives of the course are to help students increase their understanding of their own thoughts and emotions (self-awareness) as well as their ability to influence their thinking patterns and regulate their emotions (self-regulation), which are two important domains of emotional intelligence (EI), introduced by Salovey and Mayer in 1990 [39]. Since then, EI has been researched in much detail [40]–[43], including the importance of emotional intelligence for leader success [44]–[47].

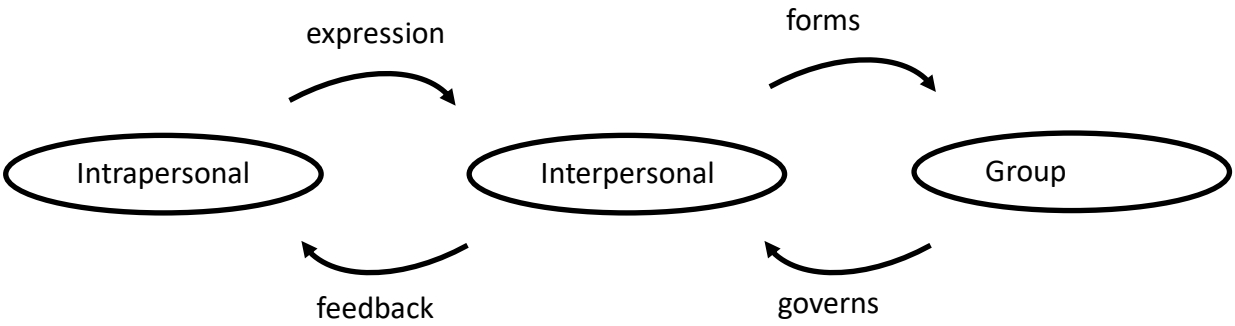

Figure 4: HIL levels of analysis

In regard to *interpersonal* skill development, the objectives of the course are twofold. First, the course should help students increase their ability to understand other people's reasoning and emotions (social awareness). Second, it should increase their ability to create and maintain trusted and productive relationships (relationship management), which are two additional domains EI [41].

In regard to understanding and influencing *group culture* (dynamics, norms, and development) [48], [49], the objectives of the course are to help students gain awareness of group-level phenomena like psychological safety [20] and increase their ability to create and maintain inclusive group culture. This culture invites group members to engage productively and to support all group members through a culture of honesty, empathy, and inclusion.

Finally, an identity lens is especially useful in elucidating the ways in which these three levels of analysis are deeply bound to one another. As individuals position themselves in society, they

receive feedback regarding the ways in which they express themselves. This means that intrapersonal growth must be validated by and negotiated through interpersonal experiences in order to integrate with one's identity. Hence, these interpersonal influential aspects both follow from intrapersonal expressions, as well as influence the intrapersonal vector. In a similar way, shared interpersonal experiences-- and how they are received and interpreted—form a group culture. Likewise, there is ongoing negotiation between interpersonal events and group-based culture. In other words, the norms that are validated during cumulative interpersonal experiences become the expectations of the group, and the group culture governs the expected parameters of interpersonal engagement. These mutually dependent relationships between the three levels of analysis reflect the complexity of living in community (Figure 4).

Connecting HIL and LID

With developmental models for interpersonal engagement (HILs) and leadership (LID) outlined, a theoretical connection between the two models may be explored. While leadership development involves a complicated process (Figure 2), many of the developmental experiences center around meaningful interpersonal experiences, which are a core component of HILs.

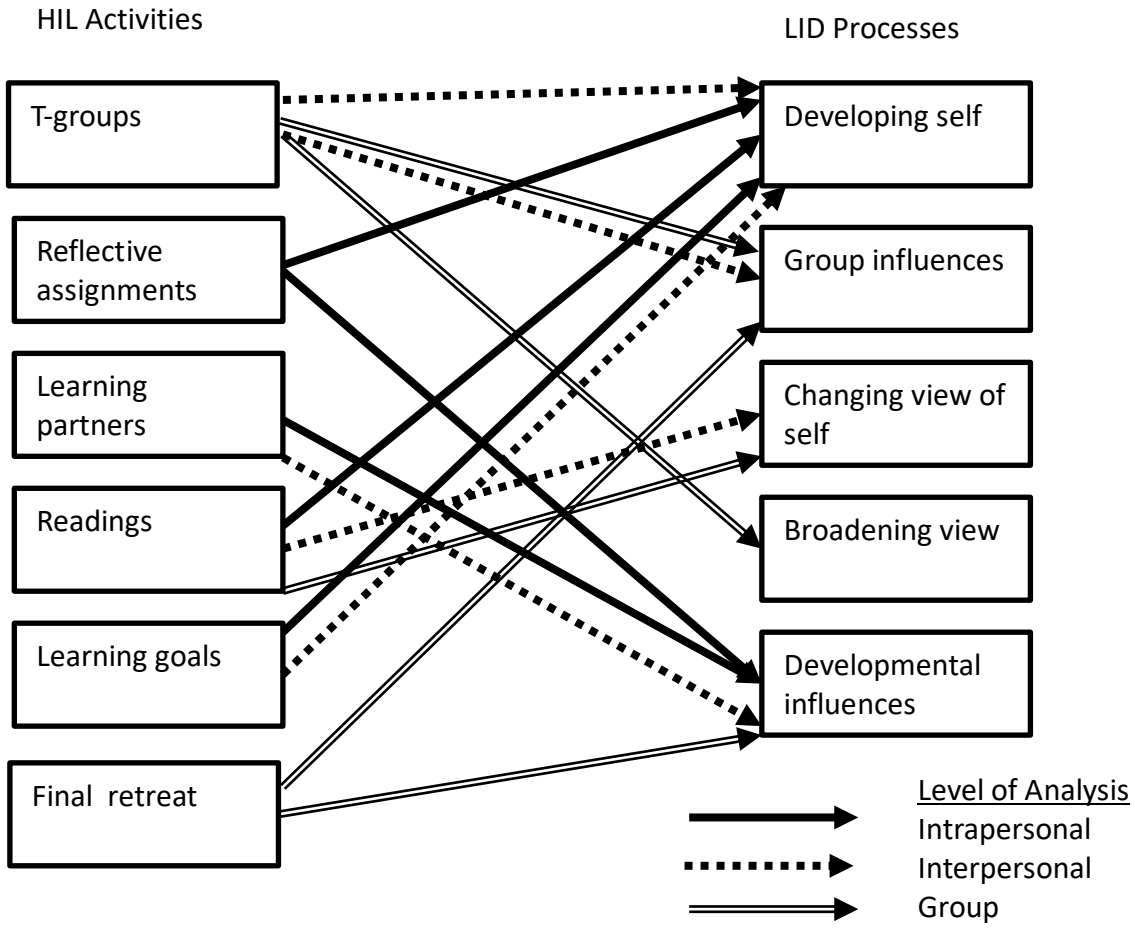

Figure 5: HIL activity connection with LID processes

An examination of the existing literature suggests that HIL activities support LID processes and mechanisms along several core pathways (Figure 5). First, T-groups provide an environment for Developing Self (though challenging interactions), engaging with Group Influences (during sharing and feedback), and Broadening View (of how to influence group behavior). Reflective Assignments address Developing self (through self-exploration) and provide Developmental Influence (through informed feedback). The third HIL activity, Learning Partners, serve to support and challenge individuals in the complexities of HILs; these peers serve as Developmental Influences along multiple levels of analysis. Readings facilitate complex ways of Developing self (through theoretical models) and Changing View of Self (through scaffolding authentic engagement and dynamic theoretical models). Participant Learning Goals support one's Developing Self (through focused cultivation of a personal goal). Finally, the Final Retreat provides opportunity for group-level experiences that can be quite powerful, reflecting the LID Group Influences and Developmental Influences (due to meaningful nature of the experience).

In summary, HIL activities map directly onto LID model processes. Moreover, the Intrapersonal, Interpersonal, and Group levels of analysis provide additional nuance for the ways in which identity is affected: the connection between these two approaches provide a model of HILs may contribute to leadership development. This practice paper will use a qualitative approach to explore these connections more in detail.

Methodology

The guiding research question in this work was the following: *How do HILs contribute to leadership identity development?* To address this question, qualitative data from previous HILs were interpreted using the three identity lenses (personal, professional, and leadership). Next, data was categorized according to emergent codes rooted in the literature. Finally, these categories were iteratively refined to address the guiding research question.

The source of the analysis was qualitative data from a previously published study [56]. This study included a total of 297 weekly reflection papers and 27 final papers from 27 undergraduate students across two independent cohorts. Additional data was collected from learning goal assignments and facilitator observations: these observations included student and group behavior in T-groups and the Final Retreat. Additional correspondence between participants and the facilitator were used to triangulate analysis. Subsequent data collection of HILs was used to add texture and weight to this analysis.

The methodology to address the guiding research question was multi-staged. First, the research team independently coded one LID process (e.g., Developing Self) according to HIL activities that supported it. Second, the research team met to review the coding, and compare (or contrast) it with the actual HIL data (both published and subsequently collected). The team iterated through these two steps until consensus was reached on the basic relationships between these two models. This process continued for all five LID processes and corresponding HIL activities.

This analysis provided clarification on the guiding research question. Next, additional discussion of the LID processes and HIL activities leveraged the previously published HIL analysis and data to add nuance and detail to understanding of the relationship between them. Finally, the cumulative impact of HIL activities were explored for their impact on LID processes, the HIL

three levels of analysis (i.e., intrapersonal, interpersonal, and group) were integrated into the findings, and divergent findings and limitations were identified.

Findings

Analysis of the data provided rich insight into the relationship between HILs and leadership identity development. Categories of this analysis emerged primarily along the three Levels of Analysis of HILs (intrapersonal, interpersonal, and group). The analysis also detailed ways in which development was impacted across all Levels of Analysis. A total of 17 themes were categorized along these boundaries (five overall concepts, four for each Level of Analysis, Figure 6)

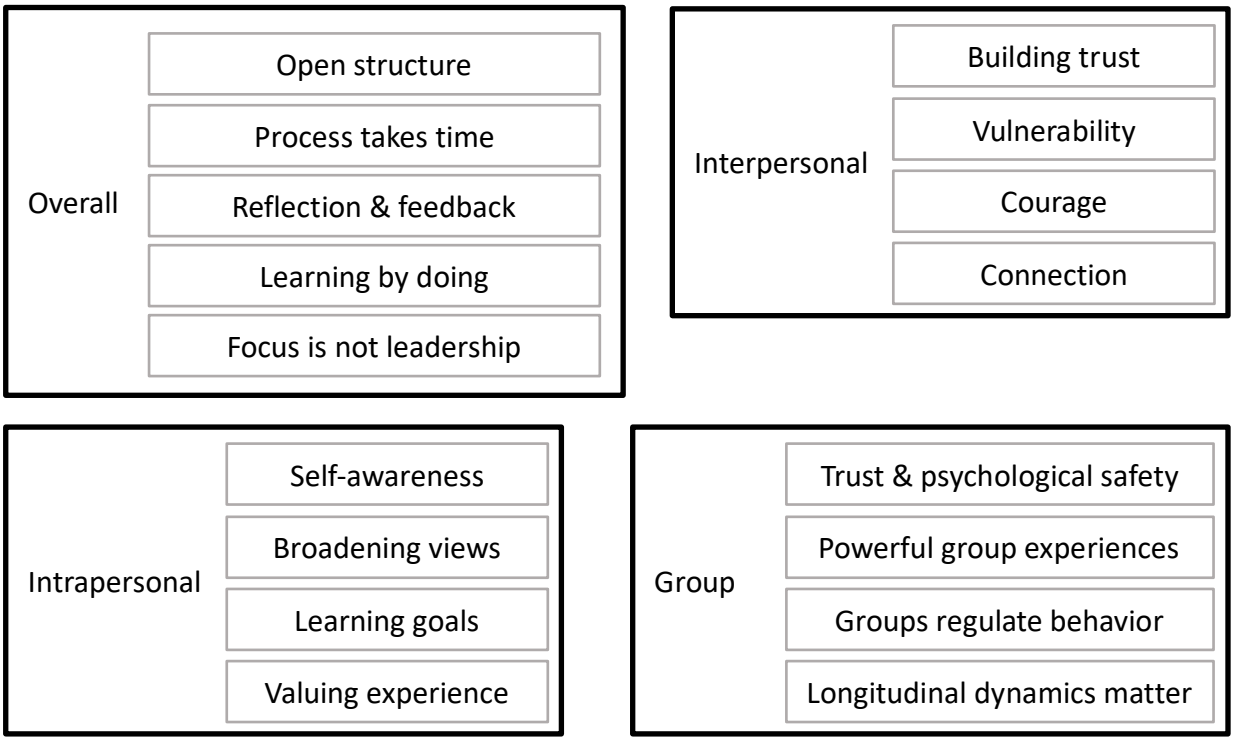

Figure 6: Findings summary, by levels of analysis

Overall HIL Impact

Five core aspects of the HIL approach impacted development across all levels of analysis. These core aspects characterize the HIL experience and provide insight into and context surrounding the three levels of analysis: *Open structure, Process takes time, Reflection and feedback, Learning by doing, and Focus is not leadership*.

Open structure is the first of these core aspects. Because of the unscripted nature of T-groups, where students dictate both the content of discussion and the rules that govern engagement, the experience is truly learner centered. This characteristic empowers students to make meaning in authentic ways, reflectively engage with others, and take responsibility for group engagement—thereby cultivating self-authorship. The impact of open structure is further supported by CoP arguments for meaningful, independent, and open-ended group experiences that include a co-

participant rather than an external authority. Hence, the value of HIL's learner-centered environment is illuminated by personal and professional identity lenses.

Second, the identity *process take time*. An important characteristic of personal growth and identity is their longitudinal and dynamic nature. For example, self-confidence generally grows through HIL experiences, but this growth takes time. Growth occurs as confidence increases; feedback mechanisms and personal choices work together to cultivate courage and self-efficacy. Members also observe changes in the intrapersonal, interpersonal, and group-level vectors, due to the dynamic nature of identity development. This reflects the LID group influence of learning from membership continuity, where longitudinal experience in a group provides more nuanced understanding of the group and its development.

The third core aspect is *reflection and feedback*. Reflection is an essential component of self-authorship development, and it is an important developmental influence in the LID model. The HIL combines intrapersonal reflection with facilitator and learning partner feedback to cultivate an authentic dialogue about emotional and cognitive topics. To aid this reflection, theoretical readings provide participants with vocabulary and scaffolding to make meaning of experiences in increasingly complex ways. In addition, the HIL model uses reflection in combination with other processes to cultivate a prescribed way of engagement that is authentic and accepting. For example, an important approach that facilitates this authentic engagement is called here-and-now communication. Participants use this technique to communicate feelings or thoughts that they are experiencing in the present moment, often based on environmental variables. This provides context for addressing specific interactions (usually tensions) in an honest, non-threatening way.

Learning by doing is the fourth core aspect of the HIL approach. As a lab, the explicit focus is on acting in and experimenting with group dynamics. Weekly T-groups, regular learning partner meetings, and the final retreat highlight the importance of learning by doing in the HIL. It should be noted that identity is based as much on an individual's beliefs and thoughts as on an individual's behaviors. Hence, acting is integral to growth: the LID model reflects this idea in self-development (Building self-confidence, Establishing interpersonal efficacy, and Applying new skills), Group Influences (Engaging in Groups), and Developmental Influences (Meaningful Involvement). Furthermore, the CoP model argues that meaningful engagement is important to a sense of belonging within a community.

Finally, HIL *focus is not leadership*; rather, the purpose is to develop a self-sufficient learning community, not unlike the expectations placed on the Professional Engineer. To this end, HILs have developed a cohesive literature base for guiding students through the complexities of intrapersonal, interpersonal, and group-based experiences. In contrast, the LID model directly addresses the development of a relational approaches to leadership: however, it only loosely outlines the mechanisms and environments that have been instrumental in that development. Hence, the LID model describes complex, personal processes (such as deepening self-awareness) in very vague and loosely defined terms. While this approach is necessary and useful in understanding overall leadership identity development, it leaves a large gap for educators to cross, should they want to intentionally cultivate more complex relational leadership development. On the other hand, HILs facilitate participant growth not only in basic interpersonal skills, but in expansive, authentic, here-and-now, respectful ways of engaging with

others. In other words, while the HIL approach may largely omit leadership from its vocabulary and foci, it provides mechanisms for actively developing healthy modes of interaction. In turn, these are the very competencies required for effective relational leadership engagement. In sum, by focusing on self-awareness, authentic engagement, and intentional group culture, HILs cultivate a secure foundation upon which effective relational leadership can thrive.

Intrapersonal Level of Analysis

The intrapersonal level of analysis is addressed by essential aspects of personal (i.e., self-authorship), professional (i.e., sense of belonging), and leadership identity (i.e., Developing Self) frameworks. Four competencies emerged as particularly powerful when viewed through an identity lens: *Self-awareness growth, Broadening views, Accomplishing learning goals, and Valuing experience*. These correspond to multiple components of the LID model.

The first competency—*Self-awareness growth*—is a core focus of several HIL activities, and it is a building block for more advanced identity development. Through the regular reflection assignments, participants explore specific emotional and cognitive reactions to T-group experiences. Through feedback from the facilitator and learning partner, intrapersonal struggles may be explored in an environment of trust and empathy. Because of the student-centered focus of the reflection, authentic engagement and identity development is more likely [19]. Out-of-class readings provide context and vocabulary for self-reflection, which are important mechanisms for identity growth [21] [23]. Most notably, the HIL promotes authentic engagement with others, where self-awareness functions as a supporting component of complex engagement practices. It should be noted that self-awareness growth as discussed here is somewhat different than the LID Changing View of Self; self-awareness is an explicit intentional focus, rather than an incidental realization related to the environment (as in change in self-view).

Second, *broadening views* characterize the developmental experiences of HIL participants. For example, participants expand their understanding of how to engage with others in meaningful ways, how to support others' vulnerability, and how to speak and listen in the here-and-now. Of particular note is that the HIL provides avenues for learning to think (via readings and feedback), feel (via reflection and T-group engagement), and behave (via T-group engagement and subsequent feedback) in more expansive ways. Again, broadening views differ from corresponding aspects of the LID model: the LID focuses on broadening view of leadership, while HILs explore broadening view of self-awareness, authentic engagement, and emotional regulation.

The third aspect of intrapersonal competencies is learning goals, which are self-initiated and often focused on internal growth. Readings often support these goals by providing vocabulary and scaffolding for complex ways of thinking, feeling, and acting. From there, discussion with learning partners clarifies and explores goals. Finally, experience in the T-groups provide the experience required to continue progress towards their learning goal. This aspect of the HIL leverages the importance of autonomy and self-directed learning in the continued cultivation of self-authorship. Moreover, it provides a learner-centered environment that empowers peers and adults as co-participants, rather than omniscient authorities that impose learning goals.

Finally, HIL participants often report increased value for more expansive ways of thinking, feeling, and acting. As a result, students often want to bring the type of culture they've experienced in the HIL to other groups in which they participate. This reflects a shift in the value systems of the students, as they long for authentic engagement in other parts of life. In fact, this is such a common occurrence that the HIL readings directly address this phenomenon. [24]. Importantly, these new values align with the explicit objectives of the HIL. This is not entirely unlike LID's Expanding Motivation. In both situations, students make sense of their experiences in terms of passions or values (e.g., charity, justice, bigger mission). However, one difference is that the HIL explicitly focuses on particular values, whereas the LID model suggests that students create meaning that aligns with group stated goals. Either way, the importance of engaging in meaningful experiences is essential in identity development [19].

In summary, intrapersonal growth is a foundational aspect of overall development which is reflected in the focus of the HILs and LID models. Moreover, self-authorship and the CoP model emphasize intrapersonal growth as a defining aspect of identity and the starting point for development into more complex ways of knowing, feeling, and acting.

Interpersonal Level of Analysis

The interpersonal vector describes the ways in which individuals interact with one another and is most visibly experienced in T-groups. The most influential processes in the interpersonal level of analysis are the following: *building trust, vulnerability received with value, moving from small acts of courage to authentic engagement,* and *feeling seen and known through connection*.

The first of these processes, *building trust*, occurs as students tentatively discuss aspects of their intrapersonal lives with learning partners and the facilitator. Through positive feedback and dialogue, trust in these individuals grows and strengthens. Eventually, individuals develop the self-confidence required to engage with the community in more vulnerable ways. This reflects perceived interpersonal efficacy in deep, meaningful modes of communication. In sum, trust is built through small acts of vulnerability being received in validating ways, meaningful feedback from others, and growth in self-confidence and interpersonal efficacy.

The process through which trust grows is the second influential aspect of the interpersonal vector: vulnerability received with value. Once students have grown along an intrapersonal vector, the next step is to engage with others in a way that reflects that growth. The research indicates that courage is the first step in interpersonal growth. T-groups provide a context for students to be exercise courage to be vulnerable. As students share, two things happen. First, they find out if they are valued by their peers. Second, peers are learning to listen empathetically and value others' existence. Hence, a student sharing provides opportunity for novice peers to value that student's vulnerability. At best, students handle both sides of the dialogue clumsily, but with good intention. From there, feedback and dialogue can scaffold more refined ways of engagement. In addition, learning partners provide a more intimate feedback mechanism on interpersonal experiences.

A third process follows from the process of increasing trust: *moving from small acts of courage to authentic engagement.* In an environment of increasing trust, participants are able to slowly experiment with self-disclosure. At first, all students play it safe, with only a handful taking

even minimal risk. As they become more comfortable with introspection via reflective assignments, their internal dialogue becomes clearer. As the previous process outlines, feedback through the facilitator provides a safe space to accept and recognize their internal dialogue. This is further validated by reading sessions and facilitator modeling. Once interpersonal engagement begins down this virtuous cycle, small acts of courage become larger and larger, as self-confidence builds. The cumulative effect of this process results in authentic engagement. While participants may experience this phenomenon in various degrees of depth and completeness, they often find authentic engagement rewarding and compelling.

The fourth component of the interpersonal vector is feeling seen and known through connection. This phenomenon is a meaningful outcome of authentic engagement; feeling seen and known is often reported by participants as a deeply rewarding experience that they take from HILs. Moreover, this experience is often a source of motivation for continued authentic engagement in environments outside of T-groups, as participants strive for deep connection with each other.s

Group-based Level of Analysis

The group-based level of analysis emerges in both the LID model (e.g., Group Influences) and in HILs. This level of analysis describes phenomena observed at the group-level, such as hostility or psychological safety. Group-level phenomena result from dialogue between interpersonal behaviors and group acceptance (or denial) of behavior. This is the process by which group norms are created, maintained, and changed. Four core aspects of the group-based level of analysis impact this research: *trust leads to psychological safety, group experiences are powerful, groups help regulate behaviors*, and *longitudinal dynamics matter*.

First, *trust leads to psychological safety*. This trend may be described by revisiting the interpersonal level of analysis. Here, trust is built through small acts of courage leading to vulnerability. These small acts lead to a virtuous cycle when self-disclosure is received in ways that value the participant, thereby resulting in increased vulnerability and appreciation. Over time, this process of self-disclosure and validation becomes normative, leading to a group culture that values and provides psychological safety. This characteristic is important for authentic engagement, which culminates in particularly meaningful experiences during the circle of trust in the final HIL retreat.

As can be demonstrated by the presence of psychological safety, *group experiences are powerful*. Amongst many participants in HILs, the group culture provides a safe place to explore and cultivate one's intrapersonal domain. And it provides a context for meaningful connection with others in the interpersonal domain. In other words, meaningful experiences for participants are dependent on a group culture that supports and values individual self-disclosure and authentic engagement. It should be noted, however, that group cultures may also erode trust, leading to potentially destructive experiences. In other words, participants describe group-level experiences as formative in both positive and negative ways in the LID literature [11]. So, a caveat to the power that strong group cultures wield is that they may be either enriching or destructive.

Third, *groups help regulate behavior*. As normative practices emerge and solidify in a group, behaviors that conflict with these norms are addressed in through NTL readings and facilitator

modeling. As a result, there are explicit, broadly recognized mechanisms for addressing deviant behavior. For example, if an individual's outgoing style silences or marginalizes another member, the group is able to correct this behavior in a civil and honest way (e.g., by using straight talk or addressing covert processes). In sum, group-level actions regulate member behaviors to fit in acceptable boundaries, which can be a stabilizing process if group culture is intentional and well-informed.

Finally, the *longitudinal dynamics matter*. As previously presented, trust eventually leads to psychological safety. In addition, the development of interpersonal efficacy leads to increasingly complex and authentic engagement. Moreover, as members experience group-level phenomena, they also observe the ways in which it changes over the semester. This leads to an appreciation of the dynamic nature not only of the group, but of the individuals that comprise it. As a result, it is common for HIL participants to share a deep connection after the semester is over, as they have shared a mutually transformative experience.

In summary, every group has norms. The power of group interactions as a formative force is readily seen in the LID model, in both constructive and destructive terms. Because these interactions are so often formative, the authors of this paper believe that group-level interactions should be constructive for everyone, even if not easy. To this end, the HIL model provides a systematic approach for guiding and cultivating a group culture that regulates behaviors to support an environment of psychological safety, authenticity, and inclusion.

Development Summary

In summary, a review of the six activities of an HIL provides insight into the many ways in which this approach cultivates personal development. An identity-based approach to understanding Human Interaction Labs illuminates the complex interactions that often contribute to intrapersonal, interpersonal, and group-level development. In addition, the types of growth seen in HILs parallel the types of experiences essential to developing a leadership identity. The growth reported by HIL participants may also be interpreted in terms of personal (self-authorship) and professional (Community of Practice) identity theories. The harmony of these interpretive frameworks supports the argument that the types of competencies cultivated through HIL participation contribute to leadership identity development. While the focus of HILs do not include leadership, they do include almost every process and required skill for engaging in effective relational leadership.

Limitations

The scope of this research means that there are a number of limitations to conclusions reached in this paper. In particular, selection of participation, operationalization variables, and scaling challenges all impact the application of the findings. First, the selection of the HIL participants was performed through interviews of undergraduate students who had voluntarily applied to this course. Because of the selection criteria (only 4th years students, alignment of student expectations with course objectives, emotional stability), the level of student commitment and skill development is likely stronger than many undergraduate students.

Second, operationalization variables impact experiences powerfully. This paper offers an analysis within the context of a semester-long HIL-based course. While triangulation of the

longitudinal data (reflections) was conducted to ensure validity, a different course structure may greatly impact findings. Moreover, the T-Group method has a mixed reputation and is known to have caused great emotional distress in some participants [54] [55]. This emphasizes the extreme importance of using qualified and well-trained T-Group facilitators. A T-Group facilitator certification from NTL, Stanford, or another comparable institution should be a minimum requirement for a person who considers offering a T-Group based course.

Finally, several practical limitations exist for HIL that are not necessarily problematic with other formats. The T-Group methodology requires a small group size (approx. 12 students) as well as qualified and well-trained facilitators. This presents a major challenge to offering the course to a bigger number of students. Weekend retreat cost can pose an additional financial challenge. Facilitator training is resource intensive. And, facilitator workload can be high, as feedback is provided to each student after most sessions.

Conclusion and Implications

This paper has presented how Human Interaction Labs cultivate core interpersonal competencies and identity. These competencies that are cultivated are essential for exercising relational leadership. More importantly, the quality of these competencies reflects values of HILs, such as authentic engagement and meaningful connection.

The Human Interaction Lab is a powerful approach to learning that is grounded in identity literature. This approach fills a need in the current state of engineering education: how to cultivate healthy, complex, and dignifying ways of engaging in professional community. This finding has implications for engineering educators striving to cultivate not only effective, but liberating, ways of leading amongst their engineering students.

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