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## **AC 2012-2965: EMBEDDING LEADERSHIP TOPICS IN THE ENGINEERING CURRICULUM**

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## **Embedding Leadership Topics in the Engineering Curriculum**

How leadership is addressed in a quantitative based curriculum has challenged engineering faculty interested in leadership for some time. This paper describes an approach to developing leadership topics within a general engineering curricular program. Through the widespread use of student projects, teams and teamwork and reflective writing, this university will teach leadership identity development along with the knowledge, skills and abilities required of the next generation of engineering leaders.

### **Introduction**

Kouzes and Posner<sup>1</sup> suggest that leadership is “everyone’s business”. East Carolina University (ECU) has committed to distinguishing itself by taking a unified institutional approach to preparing leaders. The ECU has identified itself as “The Leadership University” in its strategic position and its marketing. As part of this position, the university seeks to define student learning outcomes related to leadership development in a way that is straightforward and adaptive while allowing academic units the flexibility to identify and define discipline-specific opportunities for leadership development and practice. It is preferred that the leadership development be an accommodative platform for other purposes such as program assessment and assessment of student learning outcomes.<sup>2</sup>

According to Malzahn, Whitman and Toro-Ramos<sup>3</sup> a lack of effective leadership exists across industry, government and academe. This lack is attributed to confusion as to what/who is a leader and how leadership is related to management. Dixon<sup>4</sup> points out that leadership is a process that relates leader, follower and purpose. The role of followers in the process of leadership is often neglected, adding to the confusion. Malzahn, et. al.<sup>3</sup>, also suggest that leadership development within engineering programs may be biased by the backgrounds<sup>1</sup> of faculty and is part of the programmatic offerings of engineering management curricular for the most part.

The ECU Engineering Department in considering the University’s strategic positioning as The Leadership University is adopting the leadership initiative in a way that minimizes impact on faculty load, maximizes support from its industry constituency and provides leadership related knowledge, skills, and abilities (KSA) development opportunities for the engineering student body. The engineering program at ECU is a relatively young program. The program began in 2004, received accreditation in 2009 and currently has a student body of more than 400 students. The program continues to grow towards a goal of 750 students. The department’s Engineering Advisory Board has been active in providing recommendations and guidance in curricular development, marketing and growth strategies, and in support of classroom activities including guest lectures, capstone reviews and adjudications, and assessment processes. Recently the department began exploring the impacts of what full adoption of The Leadership University

strategy would mean to a start-up program. Currently there are no courses offered within the university on leadership for engineers.

Posner<sup>5</sup> suggests that leadership development encompassing various activities, perspectives, and experiences enhances the ability to make a meaningful difference. As a discipline and throughout history, the role of engineers as difference makers is well established primarily from an innovation focus. Engineers have also established themselves as leaders in industry, government and academe, what some call the anchors of culture<sup>2</sup>. Engineers can also be found in leadership roles in religion, one of the anchors of any society. Nonetheless, it is interesting that Posner points out that college leadership programs are developed from models and studies related to business managers. The ECU engineering program seeks to develop leadership KSAs within the context of engineering.

## **Background**

Day<sup>6</sup> suggested that, “Leadership development can be thought of as an *integration* strategy by helping people understand how to relate to others, coordinate their efforts, build commitments, and develop extended social networks by applying self-understanding to social and organizational imperatives” (p. 586). Educators can create environmental conditions that facilitate learning and support students and their groups as they struggle with that learning<sup>7</sup>. The ECU has adopted the Leadership Identity Development (LID)<sup>8</sup> staged-based model for guiding the development of students’ leadership potential. Gliddens defines identity as knowledge, emotions, abilities, and experiences that are organized around a social/professional role<sup>9</sup>. Identity development is a term used to describe the extent to which students identify themselves as a member of a leadership process<sup>10</sup>. The use of the term staged-based implies that leadership is more complex than a linear representation might imply. While stages are linear, they are also cyclical. This implies that leadership development, in accordance with the model, is more of a (engineering) system where stages are repeated, development is refined, nurtured, and expanded with each returning experience. Sometimes referred to as a helix representation, the LID reflects a deeper and more complex understanding with each cycle through a stage<sup>8</sup>. The helix representation parallels Bruner’s spiral curriculum<sup>11, 12</sup> of increasing structure complexity and higher levels of domains of knowledge with each iteration of a subject that enables students to be active participants in their own learning<sup>13</sup>. Inherent in the identity model process is a desire, or motivation, to develop an identity. Matusovich, et al.,<sup>14</sup> find that students are motivated to become engineers when values of attainment, cost, interest and utility result in persistence in meeting curricular requirements. Their work is based on Eccles<sup>15, 16, 17</sup> expectancy-value theory that has broader applications such as leadership development.

### *Leadership Identify Development*

*“A person’s identity...must continually integrate events which occur in the external world, and sort them into the ongoing ‘story’ about the self.”<sup>9</sup>*

Leliot and Turns find that identity development is a key aspect of student learning<sup>10</sup> and define professional identity “as personal identification with the duties, responsibilities and knowledge associated with a professional role.” (p631). The LID model is shown in Figure 1 as a table. The model is shown in a simplified representation for the sake of brevity. The table representation falls back to a linear representation and fails to capture the dynamic nature of the repeating development cycles, or stages, that make the model, in application, a system. The six stages of increasing leadership KSA proficiencies include: Awareness, Exploration/Engagement, Leader Identified, Leadership Differentiated, Generativity, and Integration/Synthesis<sup>8</sup>. As indicated by Thornton and Nardi<sup>18</sup>, identification with a role is a developmental process that begins with idealized perceptions of the role and progresses to a personalized congruency of one’s values and goals consistent with the requirements of the role. It is in this context that the LID stages are next described using the language of the engineering student.

*Awareness.* The awareness stage is the entry point for the LID model. It is in this stage that the engineering student begins to recognize that leadership happens “out there somewhere.” While it is expected that even freshmen students will have some awareness, the academic process at the freshman level should sharpen the awareness that students are now becoming part of a greater whole and that leadership -beyond parents-is a valued and necessary part of their emerging world. This emerging world for engineering students requires them to grasp the role of leadership in the formation of engineering and its role in society currently and historically. It serves as an expansion of the engineering student’s awareness of self and awareness as students are called on to interact with these leaders by understanding the principles and values of the engineering discipline.

*Exploration/Engagement.* As students progress in their curricular pursuits and in establishing their personal roles in the class, the university and the community, they began to experience themselves interacting with their peers. They are placed into a context where seeking opportunities to explore their numerous interests is advantageous. For developing engineering programs such as the ECU engineering program, student’s find new friendships in team/group settings such as cohorts, team assignments, and student engineering societies. Through these involvements engineering students develop interpersonal skills, build a self-concept, and build self-confidence or self-efficacy<sup>19</sup>. As maturing adults it is expected that there is a great deal of focus on interpersonal peer relationships. Team assignments provide, for the most part, a supportive environment for this development. The group assignments are often structured to student level roles and responsibilities. Students learn to aspire to roles and responsibilities within and without the classroom.

*Leader Identified.* In this stage students believe that leadership is positional, and therefore, the person in the manager’s/leader position is, in fact, the leader. If a student is not the positional leader, then they are relegated to a “lesser” role and look to the leader for direction. They believe that responsibility for getting the assignment completed is solely the leader’s

Figure 1: Leadership Identity Development Model

<b>Stages Categories</b>	<b>Awareness</b>	<b>Explore/Engage</b>	<b>Leader Identified</b>	<b>Leader Differentiated</b>	<b>Generativity</b>	<b>Integration/Syntheses</b>
<b>Stage Description</b>	<ul style="list-style-type: none"> <li>• Leadership is happening</li> <li>• Exposure through involvement</li> </ul>	<ul style="list-style-type: none"> <li>• Involvement on a broader level</li> <li>• Group experience</li> <li>• Assuming responsibilities</li> </ul>	<ul style="list-style-type: none"> <li>• Attempting new roles</li> <li>• Identifying required skills</li> <li>• Managing others; getting things done</li> <li>• Practicing different approaches/styles.</li> <li>• Leadership seen as positional</li> </ul>	<ul style="list-style-type: none"> <li>• Seeks efficacy in group process</li> <li>• Commitment to group</li> </ul>	<ul style="list-style-type: none"> <li>• Commitment to personal passion</li> <li>• Develops others</li> <li>• Promotes team learning</li> <li>• Responsible for sustaining group</li> </ul>	<ul style="list-style-type: none"> <li>• Life-long learning</li> <li>• Congruence</li> </ul>
<b>Point of view</b>	<ul style="list-style-type: none"> <li>• Leaders are out there</li> </ul>	<ul style="list-style-type: none"> <li>• Want to be involved</li> </ul>	<ul style="list-style-type: none"> <li>• Leaders get things done</li> </ul>	<ul style="list-style-type: none"> <li>• Leadership as a process</li> <li>• All responsible</li> </ul>	<ul style="list-style-type: none"> <li>• Responsible for facilitating growth in others</li> <li>• Leadership is not positional</li> </ul>	<ul style="list-style-type: none"> <li>• Confidence in ability to perform and work with and develop others</li> </ul>
<b>Self-development</b>	<ul style="list-style-type: none"> <li>• Awareness of</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize personal skills; strengths and, weaknesses</li> <li>• Build self-confidence</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize leadership potential</li> <li>• Motivation to change something</li> <li>• Involving others</li> <li>• Models leadership</li> <li>• Appreciates recognition</li> </ul>	<ul style="list-style-type: none"> <li>• Learns value of personal influence</li> <li>• Wants to serve humanity</li> <li>• Effective as leader and follower</li> <li>• Practice being engaged</li> </ul>	<ul style="list-style-type: none"> <li>• Learning from others</li> <li>• Concern for leadership pipeline</li> <li>• Concern for sustainability of ideas</li> </ul>	<ul style="list-style-type: none"> <li>• Sees leadership as life-long learning process</li> <li>• Self-actualization</li> <li>• Recognizes role as model</li> </ul>
<b>Extra-development</b>	<ul style="list-style-type: none"> <li>• Affirmation by others</li> <li>• Observation</li> </ul>	<ul style="list-style-type: none"> <li>• Leader(ship) attributed</li> </ul>	<ul style="list-style-type: none"> <li>• Assign responsibilities</li> <li>• Involving others</li> </ul>	<ul style="list-style-type: none"> <li>• Responds to meaning makers</li> <li>• Begins coaching others</li> <li>• Teaming opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Shared learning</li> <li>• Reflections</li> <li>• Anticipating opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Enables continued recycling through development process</li> </ul>

responsibility and that success or failure is the work of the leader. Students, not in the leader role, seem likely to shun accepting responsibilities and particularly lack a feeling of responsibility for failures.

*Leadership Differentiated.* At this stage, engineering students are able to differentiate their view and recognize leadership being non-positional, and “as-needed”. Leadership is starting to be recognized as a process. Those in positional roles engage in shared, participative leadership. Their responsibilities shift from making things happen to facilitator and community builder within their group(s). In so doing, students recognize that that leadership can be demonstrated by anyone in the group. Students not in positional roles experience a sense of empowerment as contributions from the team are expected/encouraged as contributions not just assignments. Students at this stage work toward building the group into a team; a community more robust than a group. Students solidify their personal commitment to be a team member, i.e., engaged and effective in pursuit of the mission or purpose of the team.

*Generativity.* In the generativity stage, students demonstrate an ability to look beyond self and express a passion for their commitments and for the care and welfare of others (Erickson, 1968). Choices are based on common interests and commitments, i.e., more transcendent purposes. Students in this stage are developing personal philosophies of leadership and demonstrate concern for the sustainability of their groups and their ideas. This is often experienced with capstone project teams. Students at this stage are interested in “giving back” by mentoring/tutoring younger students who in lower LID stages are in need of support, affirmation, and mentoring to develop their leadership capacity. These students also are more open to feedback other than an assignment grade. Students at this stage are capable of serious reflection on how they might incorporate feedback to be more effective engineers. Students at this stage have a higher value in the interdependence of people working together.

*Integration/Synthesis.* In this final stage of the LID, students have an integrated view of themselves and others working together in any context. This implies a level of self-confidence that reflect an appropriate self-esteem to trust and to be trustworthy in all circumstances. Students no longer require positional roles to feel valued as contributors or leaders. They know they are part of the leadership process when they are contributing or supporting. They recognize that they can work from any role and be engaged in leadership. They have now come to appreciate the need for openness and continued (life-long) learning both in relationships and in technical KSAs. Students at this level have congruency between values and actions. Credibility and trust are common characteristics to students at this stage of development. Another characteristic of students at this stage is the value of using experiences to reflect on values embedded in their actions. Students at this level seek opportunities to contribute to new communities as part of their continuing pursuit of self-actualization.

It is worth noting that each stage of the LID Model ends with a transition that signals the beginning of the next stage, i.e., the stages are not quantum leaps of leadership related KSAs. Transitions mark shifts in thinking; a process of letting go of the old and trying the new. When a student enters a transitional period, there is more self-observation/self-remembrance than

activity. Stage completion may or may not be finalized as students come to recognize leadership on a higher level than what they are currently experiencing.

## **ECU Adaptation**

ECU has adapted the LID model as a framework for cross-discipline pedagogies that support The Leadership University strategy while promoting academic freedom, supporting various institutional accreditation requirements, and promoting leadership development within the university community. The LID Model has been operationalized by linking the university definition of leadership with university values, strategic directions and marks of institutional distinctiveness. The university's definition of leadership is:


*Leadership is a relational process of inspiring, empowering, and influencing positive change.*

The LID model reflects an identity approach to leadership. Komives, et al., have postulated that a relational leadership identity reflects "...a sense of self as one who believes that groups are comprised of interdependent members who do leadership together, and the perception from others that one acts on that belief." This postulation is consistent with leadership as a process<sup>4</sup> and provides a basis for a framework melding the LID with ECU's conceptualization of a systems approach beginning with individual development within a community, i.e., ...*leadership is a relational process.*

The ECU chancellor, in conjunction with the faculty community, has established common values for the university, to wit: Respect, Authenticity, Accountability, Teamwork, and Commitment to Serve. In developing an integrated framework, the university has integrated its definition of leadership with its core values by redefining certain LID stages for operationalization. Figure 2 shows the alignment of the ECU stages with the LID stages. The modification is primarily directed at the LID stages, *Leader Identified* and *Leader Differentiated*. In the ECU model, those stages reflect the action oriented titles of *Application* and *Increasingly Complex Application and Behavior Development*. Other than revising the names of the stages to reflect movement and activity there are no substantive differences in the development stages.

The university's approach to student development of leadership identity has also combined the revised LID stages with "pillars" designed to reflect progress along areas of student development. Those student development areas are: *Knowledge* (Critical Thinker), *Relationships* (Mentor), *Ethics* (Active Citizen), *Well-being* (Healthy Individual), and *Service* (Catalyst for Positive Change). By identifying these development areas, in the framework the university seeks to nurture personal leadership development within individuals as they interface with and interact with their peers and the community, university and civic. The adapted model is shown in Figure 3. The "pillars" serve as linkages between the university's values and leadership identity development in a way that reflects the mission of the university in preparing students for their careers. Figure 3 provides cell definitions that define intersections of stages and development areas that are useful for tying accreditation requirements to the LID framework.

Figure 2: ECU Adaptation of LID Stages

<b>Identity Development</b> 	<b>LID Model</b>	<b>ECU Adaptation</b>
	Integration/Synthesis	Integration/synthesis
	Generativity	Generativity
	Leader Differentiated	Increasingly complex application and behavior development
	Leader Identified	Application
	Explore/Engage	Exploration
	Awareness	Awareness, knowledge

### ECU LID Framework and Engineering

As the ECU’s Department of Engineering began considering the university’s approach to LID, it became important to recognize requirements of accrediting bodies and the need to understand the implications, or rather the potential for use of the framework, in achieving accreditation goals relative to continuous improvement plans. Step 1 of this process was to address where the stages and development areas meshed with accreditation outcomes. This mesh was important as faculty resources are limited and there was, and still is, a strategic need to limit additional encumbrances upon otherwise stretched faculty resources. The state is suffering significantly from the current economic environment and this is reflected in decreasing funding for all ECU academic units. The department initiated an effort to explore commonalities between university accreditation outcomes/requirements and ABET outcomes, a-l. Figure 4 shows the results of the exploration and it can be seen that there are areas of considerable alignment. It should be noted that the descriptors within the table are presented cryptically in the interest of space. For more detail, the specific accrediting body should be consulted.

Having identified the interface between accreditation outcomes and the ECU framework, the department then undertook a process of reconciling current assessment plans with the framework, i.e., step 2. This next step was guarded by two constraints: 1) determine the cost of adoption of the university’s leadership initiative, i.e., minimize the impact on resources; and, 2) promote the engineering’s department support of leadership identity development within the engineering student body. An assessment matrix is shown in Figure 5 for the ECU Mechanical Engineering curriculum. The matrix is augmented with specific evidentiary documentation in the department’s assessment plan. This is typical for all curricular programs (concentrations within a general engineering degree) taught within the engineering department. The evidence was categorized by type (course outcomes, student work sample, and course/project evaluations) and compared to the cell definitions of the ECU LID framework for applicability in satisfying both stage and outcome “requirements”. The results are shown on a course by course basis in Figure 6. It should be noted that some course outcomes/student deliverables are not used to satisfy ABET assessment plan outcomes but are useful for LID satisfaction.



Figure 3: LID Model adapted for ECU

<b>Stage of Development</b>	<b>Knowledge Critical Thinker</b>	<b>Relationships Mentor</b>	<b>Ethics Active Citizen</b>	<b>Well-being Healthy Individual</b>	<b>Service Catalyst for Positive Change</b>
<b>Integration/ synthesis</b>	Inspiring others to learn	Mentoring and Empowering others to Mentor	Influencing action for the greater good	Reflection upon experience with self/others, commit to continual growth	Inspiring positive change
<b>Generativity</b>	Engaging in advanced scholarship and creative activity	Fostering the development of others	Challenging ethical practices in the context of the greater good	Empowering others to achieve well-being (emphasis on elements most related to leadership development)	Engaging others in service
<b>Increasingly complex application and behavior development</b>	Understanding, evaluating and communicating knowledge	Collaborating	Recognizing ethical implications of decisions	Adapting lifestyle to sustain well-being	Expanding role and commitment to service
<b>Application</b>	Using new knowledge, honing academic interests, communicating learning	Communicating effectively	Exercising values in decision making	Initiating behaviors to achieve well-being	Understanding capacity for service and narrowing commitment
<b>Exploration</b>	Recognizing learning potential, broadening knowledge base, developing effective learning strategies	Understanding interdependencies of people and environments	Examining ethical principles and relating personal values to others and organizations	Exploring avenues for achieving well-being and developing goals	Participating in service activities
<b>Awareness, knowledge</b>	Understanding accountability for learning	Understanding self and others	Understanding values	Understanding personal well-being	Understanding service and service opportunities

Figure 4: ECU Framework and Accreditation interface. Note: the Integration/Synthesis stage was determined to be beyond the scope of accreditation.

Stage of Development	Accrediting Body	Knowledge	Relationships	Ethics	Well-being	Service
Generativity	ABET	i) life-long learning				
	SACS*					
...Behavior Development	ABET	ii) life-long learning	d)... teams	f) ethics		
	SACS	1-1) understanding	1-2) conflict 1-5) collaborate 2-1) group dynamics 2-2) diversity 2-3) collaborate 4-5) leadership		3-3) lifestyle	4-6) community
Application	ABET	i) e) problem solving	g) communicate effectively	h) impacts i) life-long learning		
	SACS			4-4) ethics	3-3) lifestyle	4-1) community
Exploration	ABET	b2) analyze/interpret c) design l) contemporary issues	life-long learning	f) ethics		
	SACS		1-5) collaborate 2-1) group dynamics	1-2) conflict 4-4) ethics	3-3) lifestyle	2-5) partnerships 4-4) ethics
Awareness, knowledge	ABET		i) d) teams			
	SACS	3-2) competencies	3-2) competencies	3-2) competencies 4-3) values	3-2) competencies	

\*Southern Association of College and Schools

Figure 5: Typical Assessment Plan Matrix

Program Outcome	ENGR 1012, Graphics	ENGR 1000, Intro to Engr	ENGR 1016, Design	ENGR 2050, Comp Apps	ENGR 2022, Statics	ENGR 2070, Mtls & Processes	ENGR 2450, Dynamics	ENGR 3800, Quality Control	ENGR 3014, Circuit Analysis	ENGR 3024, Mech of Mtls	ENGR 3400, Eng Econ	MENG 3070, Thermo I	MENG 4150, Fluids	ENGR 3050, Instr	ENGR 3500, PM	MENG 3624, Solid Mechanics	MENG 4018, Thermo II	ENGR 4010 Capstone I	MENG 4650, Mach Design	MENG 4260, Heat/Mass X-fer	ENGR 4020, Capstone II
a) ...apply knowledge....			x	⊗	x	⊗	x	⊗	⊗	⊗	x			x							⊗
b1) ...design and conduct experiments								⊗	x	x				⊗							
b2) ...analyze and interpret data.			x	x		x			⊗	⊗			⊗	x							
c) ...design a system, component, or process ...			⊗		x						x	x	x	⊗	⊗		⊗	⊗	⊗		⊗
d) ...function on multi-disciplinary teams			⊗								x				⊗			⊗			
e) ...identify, formulate, and solve engineering problems				⊗	⊗	x	⊗		⊗	⊗	⊗	⊗	⊗							⊗	⊗
f) ...understanding of professional and ethical responsibility		⊗									⊗				x						
g) ...communicate effectively.	x	⊗	x	x	x	⊗			x	⊗	⊗							⊗			⊗
h) ...understand the impact of engineering solutions ...						⊗					⊗						⊗				
i) ...ability to engage in life-long learning.		x				x										⊗	⊗	⊗		⊗	⊗
j) ...knowledge of contemporary issues		x				⊗		x			⊗					⊗	x	x		⊗	
k) ...use... engineering tools...	⊗		x	⊗					⊗	x				⊗							⊗
l) ...ability to design and analyze...												x	x			x	⊗		⊗	⊗	

From Figure 6 it is seen that the constraints limiting the step 2 development process were satisfied. There is no evidence that additional course/faculty resources are impacted. However, not every stage of the LID framework is met. This is not considered detrimental as the educational process associated with leadership and the evidentiary processes of accreditation are based on sampling for progress, not complete demonstration and validation of accomplishment. It is also acceptable in that the LID itself is a continuous development process that is focused on progress not achievement.

### **Path Forward**

Currently, the department has no plans to offer specific courses in leadership for engineering students. The restrictions on credit hours to obtain a bachelor's degree do not permit expanding core or concentration curriculum. Leadership topics are covered in certain engineering electives such as the course covering entrepreneurship. With faculty workloads and contact hours being above norms, the department prefers implementing leadership topics within existing courses that discuss interpersonal relations, teamwork and what are commonly called the "soft" skills.

As part of the department's continuous improvement and in an effort to provide students with tools to aid their transitions from campus to career, the department is in the early stages of developing an electronic portfolio (e-portfolio) system of capturing student reflections of learning progress throughout their academic studies. E-portfolios are already in use within other academic units at ECU.

The ECU Department of Engineering's draft plan for using e-portfolios is provided in an academic year format:

Year 1: complete a series of creative self-assessments and personality/leadership inventories as part of classroom activities. These activities will provide insight into their leadership tendencies and personal dispositions. Students will also examine their values and beliefs, their priorities, and their short and long-range goals. Additional objectives may include: 1) various leadership styles and models; 2) leadership skills and key behaviors; 3) the role of leadership in the context of the student's life and career goals. Artifacts could include: completed inventories, completed self-assessments, personal reflections on lessons learned, and documentation of volunteer/service learning.

Years Two and Three: In collaboration with the ECU's Volunteer and Service Learning Center at ECU, students are eligible to apply learning from year one and lead by serving in community service. Artifacts could include: evidence of participation, journal of activities, service learning course assignments, and personal reflections on lessons learned. Service learning experiences supporting

Figure 6: Integration of ECU LID framework and Engineering Assessment Plan. Note: “(x)” indicates ABET outcome identifier.

Stage	Knowledge	Relationships	Ethics	Well-being	Service
<b>Integration/synthesis</b>	•Presentations to underclass				•ENGR Capstone - project specific (ABET)
<b>Generativity</b>	•Undergrad Research •ENGR Capstone (ABET)		•Ethics Open ended Case Study ENGR 3400 (f)	•Rotating team leadership •Team conflict resolution	
<b>...Behavior Development</b>	•ENGR Capstone (g)		•ENGR 1016 (f) • ENGR Capstone ( f)	• ENGR capstone	• ENGR Capstone Activity (h) •BIOE 3000 (h) •ISYS 3010/3060 (h) •MENG 4018/4650 (h) • ENGR 2070 (h)
<b>Application</b>	• Engr Courses with reports (g)	•ENGR Capstone (g) •ENGR 3024 (g) •ENGR 3500 (g) •ENGR 2070 (g) •ENGR 1000 (g)	•ENGR 3400 (f)	University Courses	
<b>Exploration</b>	• ENGR 1000 • All ENGR • ENGR 2050 (e)	•ENGR 2070 (h) •ENGR 3400 (h) <sup>6</sup> • BIOE 3000 (h) • ISYS 3010/3060 (h) •MENG 4018/4650 (h) • ISYS 3010/3060 (h)	•ENGR 3500 (f)	• ENGR Capstone)	
<b>Awareness, knowledge</b>	• ENGR 1000 • All ENGR courses	•ENGR 3500 PM Teams (ABET) •ENGR Capstone Teams (ABET)	•ENGR 1000 (f)	•ENGR 3500	• ENGR 3300 (g)

leadership development and their related artifacts would be included in the e-portfolio.

Final Year: During their final year, students will compile and finalize their leadership e-portfolios that will include a comprehensive final reflection. Students will synthesize their experiences as “My Leadership Journey at ECU,” providing a capstone experience shown to support the value of self-awareness and reflection as effective in integration of learning.

## Conclusions

ECU is publicly promoting itself as “The Leadership University,” and the use of the LID framework represents an effort to integrate student understanding of leadership into a codified and useable model. Having adopted a strategic direction that states: “ECU will distinguish itself by the ability to train and prepare leaders;” the university is now unifying its opportunities for student leadership development as well as identify the means by which it will document student learning in this realm. While no requirements have been placed on academic units, the ECU Department of Engineering has proactively initiated development of a low-resource impact, high student developmental impact initial plan for integrating leadership identity modeling into its program.

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