

**Assessing Impact of the Leadership Development Program during
the COVID-19 Pandemic**

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Abstract

The efficacy of leadership training on undergraduate engineering and technology students before and during the COVID-19 pandemic was examined. A leadership development program (LDP) at Southern Illinois University Carbondale (SIUC) emphasized active involvement and interpersonal relationship among participants to build a community of STEM leaders. The LDP recruited academically talented and economically disadvantaged STEM majors from partner community colleges and trained them as leaders. The directors framed the LPD within Social Interdependence Theory to promote and enable students to cooperatively learn to lead themselves, build leadership skills, and participate in leadership teams. The COVID-19 pandemic imposed extra challenges on implementing this model when teaching and learning switched to an online modality. Program organizers followed the program tenets and “Challenged the Process” to find innovative ways to maintain connections among and with students. Working together, students learned to apply their leadership training by organizing and completing service projects. Additionally, students practiced leadership skills within registered student organizations. Through dedication by students and coaches, the program exceeded expectations through the pandemic. The LDP continued with 100% graduation and 100% retention rates. Students in the LDP continued to show large, statistically significant gains in Leadership Self-efficacy, Motivation to Lead, and Grit compared to peers. This model of leadership development conceptually framed within the Social Interdependence Theory was effective. The LDP at SIUC is an exemplary program and could be a model for engineering leadership programs to follow.

Introduction

In the middle of the spring semester of 2020, the Southern Illinois University Carbondale (SIUC) administration informed the faculty, staff, and student body not to return to campus, and all classes switched to online format for the remainder of the semester. Like all other academic programs and organizations, the Leadership Development Program (LDP) faculty and students were faced with a significant challenge. Moreover, this cohort of hopeful leaders needed to decide quickly how they wanted to proceed with their leadership training. What would be the consequences of putting the program on hold versus adapting to an unforeseen and indefinite challenge? For most student organizations it was an easy decision to simply shutdown and wait till they returned to campus, but for the students of the LDP this was an opportunity to use this crisis to practice their leadership skills and adopt video conferencing and online learning to continue their mission of becoming the next generation of global technical leaders.

Background

The LDP was founded in 2006 as a request from industry to develop “work-ready” graduates with the fundamental skills to lead themselves, become a valued team member and know what is required to be a technical leader. The program grew steadily, attracted 10 corporate sponsors,

and was awarded two major NSF S-STEM grants. The NSF research sought to understand if early leadership training resulted in higher graduation and retention rates and faster time to graduation for academically talented, financially disadvantaged STEM majors. The preliminary results indicate a highly positive association.

The goal of the LDP has remained the same since inception, help STEM students become future leaders in industry by providing leadership training and mentoring with a cohort experience of co-curricular education and community service opportunities. Teaching and modeling authentic problem-solving to future leaders is an essential strategy and key component of the LDP of the weekly Leadership Lab and Fit to Lead physical workout course. We teach STEM majors that failure is an opportunity to learn leadership through practice and application in academic co-curricular spaces such as student organizations and service projects. The LDP research framework and an instructional approach are based upon Social Interdependence Theory, which suggests that successful achievement of group goals and individual development are accomplished through member interdependence and cooperative learning (Johnson & Johnson, 2005).

Development of technical leaders has become a critical need for the United States in helping to maintain a competitive position in a technology-based global economy [1], [2]. Creating opportunities for more diverse participation and success in STEM education and careers among underrepresented groups of women, minorities, low economic status, and persons with disabilities is especially important [3], [4]. The pandemic has changed everything, and now more than ever society and industry need effective technical leaders.

Literature Review

COVID Impact on Students and Feelings of Belonging

As of May 2021, more than 700,000 coronavirus cases have been reported on US college campuses since the start of the pandemic [5]. The long-term physical and mental health effects of this will not be fully understood for decades. In the matter of only a couple of weeks, students were thrust into the new normal of observing safe social distancing, wearing face masks nearly everywhere, and limiting the number of their peers allowed to gather in one group. These types of traumatic restrictions have a negative impact on student's experiences, wellbeing, mental health, enrollment and persistence [6], [7], [8], [9], [10]. Research has shown that both mood and wellness behaviors were also negatively affected resulting in persistent negative effects on students' behavioral and emotional functioning, particularly externalizing and attention problems [11]. Additionally, marginalized students such as racially and ethnically minoritized students and low-income students were disproportionately affected [9], [12], [13], [14].

It has long been understood that student's sense of acceptance through belonging to a group at four-year colleges may buffer students from stress, thereby improving mental health [15]. Tinto's widely cited model of college student attrition [16] concludes that the key to effective retention is in a commitment to quality education and the building of a strong sense of inclusive educational and social community on campus. For a college student, a sense of belonging and academic persistence is inextricably linked to the use of campus services, and good mental health

[17]. The mental health impact of social isolation caused by the pandemic erodes the opportunity for students to establish belongingness in their college community, thus threatening their mental wellbeing and persistence to complete their educational goal. Smith, et.al [18] found that the pandemic caused the disappearance of interpersonal networks featuring coworkers and academic ties, as well as reductions in students' overall number of connections made possible continued reduction of peer academic relationships.

Faced with leading a university through a pandemic for their first time, university leaders lacked information, experience, resources, and time; human safety was paramount and they did the best that they could. In hindsight, prudence would dictate a proactive response to plan and implement student online social programming to promote a continued sense of belonging and connectedness. This approach draws upon the Situational Awareness Model [19]. Situational awareness is knowing the environment and its implications for people in the present and the future. This model is especially relevant for situations characterized by a high level of volatility, uncertainty, complexity and ambiguity; such as a global pandemic.

While university leaders deployed the situational awareness model, students of the LDP did the same and contemplated how to uphold the mission, vision and values of their program.

Mission: Through teamwork, we achieve excellence by pushing harder, faster, and further in everything we do.

Vision: To become the premier university leadership program that empowers and transforms people and organizations around the world.

Values: Safety, Honesty, Accountability, Respect, Empathy, Dedication

They were keenly aware of what was going on in their environment and the implications their decisions would have on their personal leadership development and advancement of the LDP vision. Prior students in the LDP have a strong record of leading successful projects, programs and student organizations. One of their notable achievements is being recognized twice with the university's highest student service honor, the Delyte Morris Award for Excellence in Student Service. This history of success led students to embrace the challenge before them and to use the pandemic to strengthen their leadership skills, a collective confidence developed through the use of member interdependence and cooperative learning, central practices of Social Interdependence Theory.

Social Interdependence Model

The LDP uses a research framework and an instructional approach based upon Social Interdependence Theory [20]. Social interdependence is a theory of cooperation, which suggests that successful achievement of group goals and individual development are accomplished through member interdependence and cooperative learning. Programs that use cooperative social interdependence teaching and learning strategies, compared to competitive or more individualistic models, result in greater achievement and more productive and positive relationships [21], [22]. The LDP uses the social interdependence approach to develop a curriculum of self-leadership, teamship and organizational leadership, which has demonstrated

significant improvement in undergraduate's graduation rate and time to graduate [23]. Moreover, this research indicates the LDP model is highly effective and positively impacts students' success in terms of academic performance, leadership and soft skills development, graduation, and career placement. We wanted to determine how effective the LDP model was during the pandemic.

Methods

An external program evaluation of the LDP was conducted independently each year using a student survey comprised of three constructs: Leadership Self-Efficacy (LSE), Motivation to Lead (MTL), and the Grit-8 Scale. LDP students typically spend two years in the program. New (first year) students in the LDP completed a pre-survey when entering the program at the start of the fall semester in years 2018-2020. After each year of the program, students then completed a post-survey (Post for 1st year students or Post2 for 2nd year students) in the spring semester.

For this project, a control group of non-LDP peers was required annually. Students for this peer comparison group were identified through the Office of Institutional Research ensuring that the students met the same requirements as candidates for the LDP. All comparison group students were STEM major transfers with a 3.0 or higher GPA and a minimum of 60 transfer credit hours. The program coordinator then contacted the identified students and requested they complete the LSE, MTL and Grit research surveys to receive a small gift card.

A *t*-test was used to compare LSE, MTL and Grit scores of students in the LDP and with the peer comparison group. A Wilcoxon Signed-rank test was used to compare matched pre-test to post-test scores of LDP students. A Kruskal-Wallis test was performed to analyze the dimensions of each survey for differences among the three groups (pre-, post-, control).

In addition, survey responses and focus group data were gathered from LDP students, mentors and coaches to provide insight on the value and quality of the program. Finally, community organizers for service projects and program sponsors were also given a project survey to gain feedback from a stakeholder perspective.

Leadership Self-efficacy

Self-efficacy is an individual's belief in their ability to successfully face specific tasks or situations [24]. Leaders with a high self-efficacy are known to be goal-oriented, motivated, resilient to adversity, and ability to think clearly under pressure. The Leadership Self-Efficacy Scale (LSE) [25] contains 21 items tied to six correlated dimensions (Starting and leading change processes in groups, Choosing effective followers and delegating responsibilities, Building and managing interpersonal relationships within the group, Showing self-awareness and self-confidence, Motivating people, Gaining consensus of group members).

Motivation to Lead

Chan [26] defines Motivation to Lead (MTL) "*as an individual differences construct that affects a leader's or leader-to-be's decisions to assume leadership training, roles, and responsibilities and that affect his or her intensity of effort at leading and persistence as a leader.*" (pp. 482) The

dimensions on the MTL were defined by Chan [26]. According to Chan, the three dimensions can be understood as follows:

- Affective Identity is directly related to extraversion, vertical individualism, past leadership experience and leadership self-efficacy.
- Non-calculative is directly related to agreeableness, emotional stability and collectivist values whereas individualistic values were negatively related.
- Social-normative is directly related to a sense of social duty and obligation. Accepting of social hierarchies but rejecting of social equality.

Grit Scale

Active LDP students were administered the Grit-8 12-item scale [27] as a self-administered web-based scale to determine the students' "trait-level perseverance and passion for long-term goals" [28]. Duckworth's Grit scale has predictive reliability for identifying individuals who are capable of sustaining efforts and interest in projects that take long periods of time to complete (i.e., months or years). The premise of Grit and the use of the Grit scale is complementary to the LDP research question to study the "degree (to which) LDP program students achieve at a higher level than comparable non-participating students."

The data were analyzed using the Grit-8 approach [28]. Going forward students only will complete the eight-item scale. The eight items of interest were corrected for reverse questions, assigned appropriate scores (from 1 to 5), added together and divided by eight. A resulting average scale score ranged from 1 (least gritty) to 5 (most gritty).

To create Grit levels, the evaluators analyzed the scale documentation for scale application for individuals with Grit. Duckworth & Quinn [28] state that individuals who have a grit score of 1 standard deviation above the mean are "grittier" and more likely to succeed in difficult tasks like participation in the Scripps spelling bee. Considering the overall scale mean was 3.4 and the standard deviation was 0.8, the evaluators identified the following Grit categories outlined in Table 1.

Table 1. Defined Grit Categories

Grit Category	Scale Range
Very Gritty	4.2 – 5.0
Above Average Grit	3.4 – 4.19
Below Average Grit	2.6 – 3.39
Low Grit	1.0 – 2.59

Results

Demographics of the LDP students as listed in Table 2. Students' success in the LDP was assessed each year using three constructs: 1) Leadership Self-efficacy, 2) Motivation to Lead,

and 3) Grit. Student scores and results for each construct are presented by academic year. In addition, survey responses and focus group data gathered from students, mentors and community leaders to provide insight on the value and quality of the program are presented.

Table 2. Demographics of LPD Completers in Academic Years 2018-2021

	2018-2019	2019-2020	2020-2021
Female	8	9	6
Male	19	16	10
STEM	15	14	10
Engineering	12	11	6
1st Year Student	20	12	10
2 nd Year Student	7	13	6
Total LDP	27	25	16

Leadership Self-efficacy (LSE)

2018-2019 LSE Results

Students in the program showed statistically significant differences ($p = 0.007$) on the survey for Leadership Self-efficacy between all LDP students pre-tested in spring 2018 and post-tested in spring 2019.

Wilcoxon Signed-Rank Test on Leadership Self-efficacy (2018-2019 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>median</i>	<i>z-score</i>	<i>p value</i>	<i>effect r</i>
Pre-Test	11	4.03	0.592	3.95	2.34	0.007	0.500
Post-Test	11	4.61	0.343	4.67			

Students in the program showed statistically significant differences ($p = 0.0007$) on the survey for Leadership Self-efficacy when compared with a control group of student peers.

T-Test on Leadership Self-efficacy (2018-2019 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Variance</i>	<i>std err</i>	<i>t-stat</i>	<i>df</i>	<i>p-value</i>	<i>effect r</i>
Post-Test	11	4.61	0.118	0.12	3.76	18.15	0.0007	0.662
Control Group	29	4.15	0.118					

A Kruskal-Wallis test on the dimensions of the survey on Leadership Self-efficacy showed statistically significant differences for the LDP program group responses on the pre-test or post-test than the control group's responses ($p < 0.001$). The LDP program students rated all six dimensions similarly while the control group rated *Starting & Leading* change processes in groups much lower and *Building & Managing Interpersonal Relationships within the Group* much higher (Figure 1).

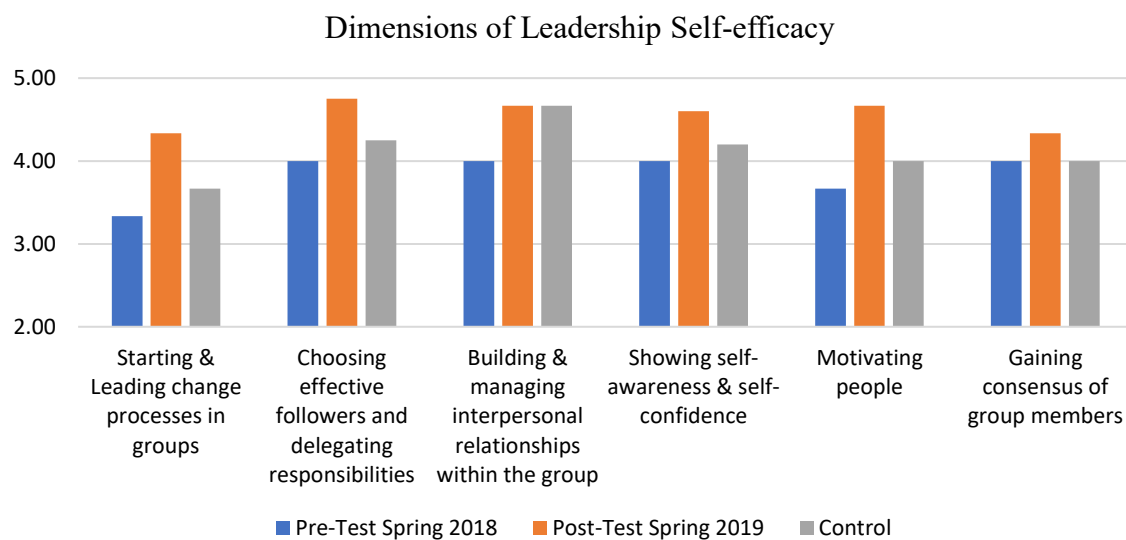


Figure 1. Dimensions of Leadership Self-efficacy

2019-2020 LSE Results

The 2019–2020 cohort of LDP students showed statistically significant improvements in Leadership Self-efficacy when their post-test scores were compared with their pre-test scores ($p = 0.028$).

Wilcoxon Signed-Rank Test on Leadership Self-Efficacy (2019-2020 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>median</i>	<i>z-score</i>	<i>p-value</i>	<i>effect r</i>
Pre-Test	18	4.17	0.578	4.21	1.88	0.028	0.313
Post-Test	18	4.42	0.440	4.48			

They also demonstrated statistically significant higher LSE when compared with a control group ($p = 0.011$).

T-Test on Leadership Self-Efficacy (2019-2020 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Variance</i>	<i>std err</i>	<i>t-stat</i>	<i>df</i>	<i>p-value</i>	<i>effect r</i>
Post-Test	18	4.42	0.194	0.15	2.37	40.72	0.011	0.348
Control	25	4.05	0.322					

2020-2021 LSE Results

The 2020–2021 cohort of LDP students showed an overall slight improvement in Leadership Self-efficacy when their post-test scores were compared with their pre-test scores ($p = 0.29$).

Matched T-Test on Leadership Self-Efficacy (2020-2021 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>t-stat</i>	<i>p-value</i>	<i>effect r</i>
Pre-Test	23	4.15	0.590	0.295	0.29	0.140

Post-Test 23 4.23 0.470

They also demonstrated statistically significant significantly higher LSE when compared with a peer control group ($p = 0.03$).

T-Test on Leadership Self-Efficacy (2020-2021 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>t-stat</i>	<i>p-value</i>	<i>effect r</i>
Post-Test	25	4.26	0.470	0.031	0.030	0.420
Control	23	4.08	0.410			

Across all data points (Pre-test and Post-test), females rated themselves higher on *Affective Identity* but lower on *Non-Calculative* and *Social Normative* compared to their male counterparts. These differences suggest further study is needed.

As shown in Table 3, LDP students' pre-test LSE scores remained very similar before and during the pandemic. Post-test LDP scores increased significantly pre-COVID and slightly during the pandemic. However, the LPD students' LSE was markedly higher than the comparison group before and during the pandemic.

Table 3. Leadership Self-efficacy for Last Three Academic Years

	2018-2019	2019-2020	2020-2021
Pre-Test LDP Group	4.03 (11)	4.17 (18)	4.12 (26)
Post-Test LDP Group	4.61 (11)	4.42 (18)	4.26 (25)
Control Group	4.15 (29)	4.05 (25)	4.08 (33)

Motivation to Lead (MTL)

2018-2019 MTL Results

A similar analysis was performed on the Motivation to Lead and shows very similar results and the same trends as the Leadership Self-efficacy results. Students showed improved Motivation to Lead when their post-test scores were compared with their pre-test scores ($p = 0.010$).

Wilcoxon Signed-Rank Test on Student's Motivation to Lead (2018-2019 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>median</i>	<i>z-score</i>	<i>p value</i>	<i>effect r</i>
Pre-Test	10	3.91	0.435	3.85	2.24	0.010	0.501
Post-Test	10	4.16	0.264	4.06			

They also demonstrated higher differences that were statistically significant ($p < 0.001$) on the Motivation to Lead survey when compared with a control group.

T-Test on Student's Motivation to Lead (2018-2019 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Variance</i>	<i>std err</i>	<i>t-stat</i>	<i>df</i>	<i>p-value</i>	<i>effect r</i>
Post-Test	10	4.16	0.070	0.09	11.72	10.73	< 0.001	0.963
Control Group	29	3.13	0.019					

Additionally, a Kruskal-Wallis test on the dimensions of the survey on Motivation to Lead showed significant differences in pre-test and post-test scores ($p = 0.006$). The control group responded lower on the dimension *Non-calculative* while the students in the program, both pre- and post-test, responded higher ($p < 0.001$).

2019-2020 MTL Results

The 2019-2020 cohort of LDP students showed a practical improvement in MTL when their post-test scores were compared with their pre-test scores. However, the increase was not statistically significant ($p = 0.410$).

Wilcoxon Signed-Rank Test on Student's Motivation to Lead (2019-2020 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>median</i>	<i>z-score</i>	<i>p-value</i>	<i>effect r</i>
Pre-Test	17	3.85	0.450	3.88	0.23	0.410	0.040
Post-Test	17	3.83	0.241	3.81			

They also demonstrated significantly higher MTL when compared with the control group ($p = 0.038$).

T-Test on Student's Motivation to Lead (2019-2020 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Variance</i>	<i>std err</i>	<i>t-stat</i>	<i>df</i>	<i>p-value</i>	<i>effect r</i>
Post-Test	17	3.83	0.058	0.11	1.83	38.08	0.038	0.284
Control Group	25	3.63	0.209					

2020-2021 MTL Results

Students' overall MTL scores did not increase in the 2020-2021 academic year.

T-Test on Student's Motivation to Lead (2020-2021 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>t-test</i>	<i>p-value</i>	<i>effect r</i>
Pre-Test	23	3.85	0.34	0.462	0.460	0.380
Post-Test	23	3.84	0.42			

Students in the LDP demonstrated large and statistically significant gains on Motivation to Lead compared to their peers ($p < 0.00$).

T-Test on Student's Motivation to Lead (2020-2021 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>t-test</i>	<i>p-value</i>	<i>effect r</i>

Post-Test	25	3.86	0.33	0.002	0.00	0.73
Control Group	25	3.57	0.45			

As shown in Table 4, students' pre-test MTL scores remained very similar before and during the pandemic. After LDP training post-test scores increased slightly pre-COVID, but MTL did not change much during the pandemic overall. Students continued to show gains in Leadership Self-Efficacy and Motivation to Lead with some large, statistically significant gains in certain dimensions such "Starting and Leading Change Processes in Groups", "Choosing Effective Followers & Delegating Responsibilities", "Motivating People" and "Affective Identity". The LDP students demonstrated significantly higher MTL when compared with a peer control group before the pandemic and slightly higher during the pandemic.

Table 4. Motivation to Lead for Last Three Academic Years

	2018-2019	2019-2020	2020-2021
Pre-Test LDP Group	3.91 (10)	3.85 (17)	3.82 (25)
Post-Test LDP Group	4.16 (10)	3.83 (17)	3.86 (25)
Control Group	3.13 (29)	3.63 (25)	3.57 (33)

Grit

2018-2019 Grit Results

Wilcoxon Signed-Rank Test on Grit-8 (2018-2019 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>median</i>	<i>z-score</i>	<i>p-value</i>	<i>effect r</i>
Post-Test	11	3.91	0.27	3.88	1.07	0.142	0.228
Post-Test 2	11	3.72	0.55	3.88			

Grit scores (Duckworth & Quinn, 2010) ranged from "Low Grit" to "Very Gritty" with a distribution across four defined Grit categories (see Table 1). LDP students, overall, had an average Grit score (Mean = 3.72) only slightly higher than the population mean ($\mu = 3.40$). Further, Grit did not appear to increase based on the years in the program. The post-test scores for Grit decreased slightly but this change was not statistically significant.

2019-2020 Grit Results

Wilcoxon Signed-Rank Test on Grit-8 (2019-2020 Cohort)

	<i>N</i>	<i>Mean</i>	<i>Std Dev</i>	<i>median</i>	<i>z-score</i>	<i>p-value</i>	<i>effect r</i>
Pre-Test	7	3.50	0.30	3.50	0.183	0.428	0.049
Post-Test	7	3.46	0.30	3.50			

Grit ranged from "Low Grit" to "Very Gritty" with a distribution across the four defined Grit categories. All survey groups (pre-test, post-test, and control,) had slightly higher Grit scores than the population mean ($\mu = 3.40$). While no statistically significant differences were observed

between any of the groups (pre-test, post-test, control), it is interesting to note the changes in Grit categories between groups (Figure 2).

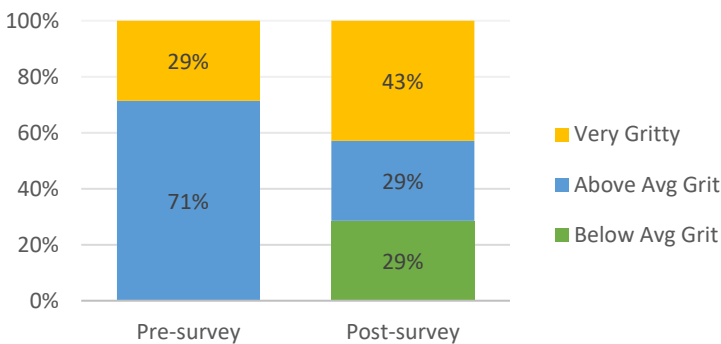


Figure 2. 2019-2020 LDP cohort pre-test and post-test Grit categories.

For example, for the 2019-2020 cohort, only 29% were “Very Gritty” before the program, but after one year, 43% of students were “Very Gritty”. This may suggest that students experienced a response-shift bias and likely overestimated their Grit score on the pre-test.

2020-2021 Grit Results

The LDP students continue to score “grittier” on the Grit8, both before and after the program, than their peers. It appears that LDP students are slightly less “gritty”, or at least their scores are slightly less after participating in the program. However, mentors and coaches universally agreed that the LDP improves students’ awareness of leadership skills, persistence and grit, and their engagement in leadership activities. Students’ decrease in Grit scores may indicate improved appreciation for the concept of leadership, though more data is needed to justify any claims on this subject.

Table 5. Grit Scores for Last Three Academic Years

	2018-2019	2019-2020	2020-2021
Pre-Test LDP Group	4.06 (9)	3.90 (17)	4.01 (15)
Post-Test LDP Group	3.66 (22)	3.76 (11)	3.78 (22)
Control Group	3.40 (*)	3.61 (22)	3.53 (33)

* Note: Population mean (μ) used as comparison group (Duckworth & Quinn, 2010)

As shown in Table 5, LDP students’ pre-test Grit scores remained very similar before and during the pandemic. Post-test LDP scores decreased significantly pre-COVID and also decreased noticeably during the pandemic. A drop from pre-test to-post-test Grit was observed throughout the three academic years. However, LPD students’ Grit was markedly higher than the comparison group before and during the pandemic.

Table 6. Summary Data of Mean Score Reflect No Significant Change across Academic Years

	2018-2019	2019-2020	2020-2021

Leadership Self-efficacy	4.61 (11)	4.42 (18)	4.26 (25)
Motivation to Lead	4.16 (10)	3.83 (17)	3.86 (25)
Grit-8 Scale	3.72 (26)	3.46 (7)	3.78 (22)
Graduation	100% (9/9)	100% (11/11) *2 additional in UG	100% (3/3) *3 additional in UG

Student-Led Service Projects before and during the Pandemic

At the end of each year, LDP students, coaches, and community leaders responded to open ended survey questions and participated in focus groups to provide feedback on student-led service projects. In academic year 2018-2019, the focus group with second-year students, found at least ten instances of carry-over of student leadership skills to other organizations outside LDP were identified. Of those nine instances, five involved LDP students using skills in corporate settings, four involved other organizations within SIU, and one occurred in the local community. The evaluation did not effectively study institutional, corporate or community transformation beyond involvement of corporate leaders with the Team Week exercises and Team Week Kaizen projects at a manufacturing solutions provider in the Chicago suburbs. Further analysis is required for future years to determine the impact of the program on SIUC, regional corporate organizations, and further application of the program at other institutions of higher education.

During the 2019-2020 academic year, the program coordinator surveyed six organization leaders at the completion of a particular project. Responses received from six organizational leaders regarding student-led service projects conducted fall semester before the pandemic and in spring semester with the onset of the pandemic mid-semester were highly agreeable (Figure 3). All six organizations overwhelming agreed the LDP student leadership exceeded their expectations. With regard to a community service project during MLK Volunteer Day a community leader commented, *“The team was respectful, kind, and hardworking. They should be proud of the work that they complete for the community.”*

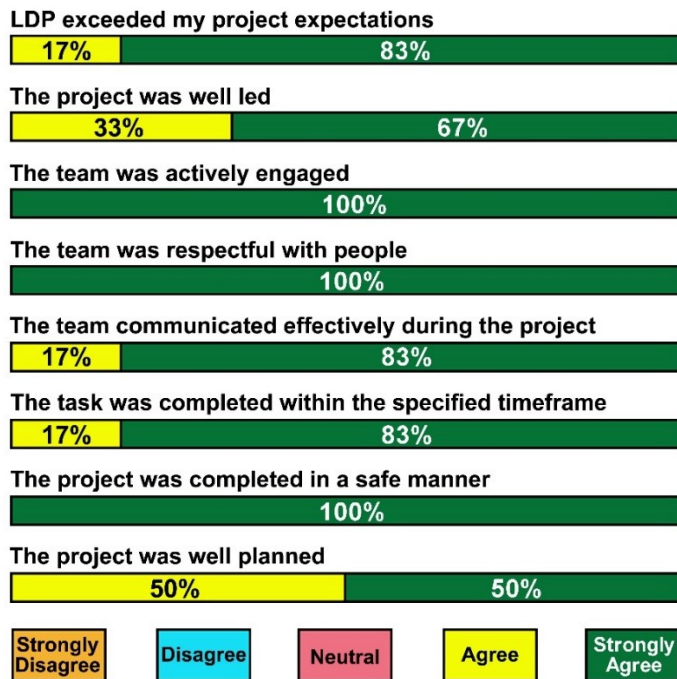


Figure 3. Organization leader responses on student-led projects in 2019-2020 academic year.

The LDP project team upheld the program’s SHARED (*Safety, Honesty, Accountability, Respect, Empathy, Dedication*) core values, such as respect and safety, once again in AY 2019-2020. Additionally, LDP coaches’ comments on key program events led by students were positive and in agreement with the organization leaders. For example, the LDP students demonstrated accountability and dedication when asked by the SIUC Administration to host the Higher Learning Commission Accreditation committee during their campus visit. LDP students were responsible for setting the schedule of events and chaperoning the evaluation committee members as they reviewed the campus. This high honor demonstrates the depth of the University’s trust in the LDP program.

During the extended COVID-19 pandemic protocol in academic year 2020-2021, the LDP student-led projects continued to have a positive effect on and off campus communities. In the annual survey and focus group data, LDP coaches and students (Table A) commented on successful community projects and leadership within Registered Student Organizations (RSOs). Eighty percent of students, faculty, and community leaders independently “Agree” or “Strongly Agree” that the LDP met program objectives and provided value to the program participants. Coaches and students also noted that organizations within SIUC continue to reach out to LDP to organize and conduct events on campus. The LDP continued to demonstrate significant leadership through organizing or participation in multiple events: a) the Annual LDP Food Drive raised over \$5,000; b) raised over \$3,000 for a family in need (Axel’s 5K); c) registered 126 Donors at Red Cross Blood Drive; d) contributed 60 hours of trail building at Touch of Nature Outdoor Education Center; e) sent two teams to the Collegiate Leadership Competition (CLC) Impact Challenge; and f) raised over \$25,000 for SIUC Day of Giving to improve the College of Engineering’s student facilities. The number and amount of corporate sponsorships increased.

Four LDP students interned at sponsoring corporate institutions, and five students started careers at sponsoring corporate institutions.

Program Quality Survey

A program survey was emailed to all students and coaches each spring to gather additional insight on the overall value and quality of the LDP. Results of the 2019 program quality survey revealed, in aggregate, 95% of the students and 100% of the Coaches agreed with the items on the survey concerning program quality. Students and program coaches perceive the LDP program to be valuable and gave very high ratings for program quality before, at onset, and during the COVID-19 pandemic.

The 2020 program quality survey results showed that 95% of students agreed (i.e., selected either “Agree” or “Strongly Agree” on the Likert scales) that the program was valuable. Students felt the program met their expectations, they would recommend it to their peers, and that they would participate in the program again if given the opportunity. The coaches universally agreed that the LDP improves students’ awareness of leadership skills, persistence and grit, and their engagement in leadership activities. Additionally, students provided the following comments open-ended questions about the quality of the program.

“I learned how to be a good follower, which in turn helped me improve my leadership skills.” (1st Year Student)

“This program has taught me how to lead myself so that I am more comfortable and capable to lead others.” (2nd Year Student)

“The LDP has refined my soft skills and helped given me the communication skills to lead an effective team.” (2nd Year Student)

“This program has been the best part of my first year as a transfer student.” (1st Year Student)

“Thank you for everything you do. People are growing more than they ever would in any other group and lives are being changed.” (2nd Year Student)

“This program has changed my life and I will forever be grateful that I had this experience.” (2nd Year Student)

In 2021, on all program quality survey questions, 90% or more of students agreed (i.e., selected either “Agree” or “Strongly Agree” on the Likert scales) that the program was valuable. Students felt the program met their expectations, they would recommend it to their peers, and that they would participate in the program again if given the opportunity. The faculty universally agreed that the LDP improves students’ awareness of leadership skills, persistence and grit, and their engagement in leadership activities.

Discussion

The evidence collected and analyzed suggests the LDP model and social interdependence framework were essential to the program success before and during the pandemic. The LDP

continued to demonstrate a sustained impact on institutional, corporate, or community transformation during the pandemic.

A breakdown of both the LSE and MTL by the dimensions assessed within those instruments reveals that students showed the most growth in *Starting and Leading Change Processes in Groups, Choosing Effective Followers & Delegating Responsibilities, Motivating People* and *Affective Identity*. Additionally, LSE and MTL scores for LDP students were higher compared with their peers and statistically significant. The small (statistically insignificant) improvement of students' MTL scores (pre-test and post-test) in 2019-2020 probably indicates a pandemic effect. Interestingly, LDP students' MTL scores were significantly higher than their peers in the 2019-2020 academic year. Also, LDP students' LSE scores increased significantly during the same time period and were much higher than their peers. However, in 2020-2021 LDP students exhibited no increase in LSE but had a significantly higher LSE than their peers. Students' MTL scores increased significantly pre-post and compared to their peers for the 2020-2021 academic year. It is important to note that LDP students continued to score "grittier" on the Grit8, both before and after the program, than their peers. Although students may be overestimating their grit before LDP training.

The social interdependence theory is credited in this research for creating a group of self-confidence students willing to take on challenges, such as adapting their leadership training to an online platform because of the pandemic. A practice used in the LDP and component of the social interdependence model is developing a growth mindset. According to Dweck and Yeager [29], "A growth mindset is the belief that human capacities are not fixed but can be developed over time, and mindset research examines the power of such beliefs to influence human behavior." LDP Students are encouraged to challenge themselves by moving out of their comfort zone and into their growth zone, i.e., growth mindset. Successful leaders like to test their limits and persevere, even when it is not going well. This mindset allows people to thrive during some of the most challenging times in their lives, such as a global pandemic, and is more effectively learned in a supportive environment of social interdependence.

The challenge of the pandemic led to students initially depend more on the LDP second year student leadership and coaches for support rather than the interdependence of students that is typical in the program. However, going to a virtual mode of the program during the pandemic challenged students to effectively adapt normal face-to-face strategies of leadership development and ultimately produced an adequate digital cooperative learning and member interdependence space. Students worked with each other and used a team strategy to effectively model problem-solving in converting the LDP weekly Leadership Lab and Fit to Lead physical workout course to online modalities. Overall, the evidence suggests the LDP model and social interdependence framework were essential to the program success before and during the pandemic.

Conclusions

The LDP emphasized active cooperation and interdependence among participants to build a community in which students could learn to lead and address the challenges imposed during the COVID-19 pandemic. While the program did not look the same this past year as in previous years, program organizers followed the tenets of their program and "Challenged the Process" to

find innovative ways to maintain connections with their students. During focus group conversations, coaches noted that several of the changes imposed by the pandemic made positive impacts on their program and will be kept going forward in a “post-COVID” world. Through dedication by LDP coaches and students, the program exceeded expectations through the pandemic. The program continued its 100% graduation and 100% retention rates. LDP students took action in leading and converting key components of the program to online learning and service. They continued to show gains in Leadership Self-Efficacy and Motivation to Lead with some large, statistically significant gains in certain dimensions such “Starting and Leading Change Processes in Groups”, “Choosing Effective Followers & Delegating Responsibilities”, “Motivating People” and “Affective Identity”. LDP students scored higher on all three leadership constructs at the end of the program year, and fared much better than their peers during the pandemic.

These research findings on the LDP model at Southern Illinois University Carbondale may help educators and other leadership mentors learn and benefit their programs. The LDP research framework and instructional approach are based upon Social Interdependence Theory, which suggests that successful achievement of group goals and individual development are accomplished through member interdependence and cooperative learning (Johnson & Johnson, 2005). Developing technical leaders includes creating opportunities for more diverse participation among underrepresented groups of women, minorities, low economic status, and persons with disabilities. The pandemic has changed how academic institutions accomplish this task. The LDP model of social interdependence has aided STEM majors to adapt, persist and grow through the pandemic in leadership self-efficacy, motivation, and grit. This model can be adapted and used by other institutions to create even more technical leaders.

Acknowledgements

Support for this research provided in part through the NSF S-STEM Track 2 Award # 1644166 and Southern Illinois University Carbondale.

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