MEASUREMENT OF LIFE SKILL ACQUISITION OF THE IDAHO FIRST LEGO® LEAGUE STATE TOURNAMENT PARTICIPANTS AGES 9-14

by

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ABSTRACT

Youth development programs provide opportunities for children to learn and apply the life skills they are likely to utilize later in life. Therefore, it is critical that steps are taken to evaluate their effectiveness. The direct purpose of this study was to measure life skill outcomes of participants ages 9-14 of the Idaho FIRST LEGO® League program state tournament participants. This mixed method pre-experimental design study incorporated quantitative measurements using a paired samples test and qualitative measures utilizing a single-category design focus group methodology for triangulation purposes. This study contributes to the literature by providing empirical evidence of the formation of life skills in youth participating in a nationally sponsored robotics engineering program.

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CHAPTER 1: INTRODUCTION

Background

The goal of youth development programming is to make opportunities available for youth to experience and apply the practical application of life skills so they may be readily utilized later in life. The National Cooperative Extension System not only develops various programs for youth life skill development, but has established partnerships with other organizations that facilitate the development of life skills such as FIRST LEGO® League. The FIRST (For Inspiration and Recognition of Science and Technology) LEGO® League (FLL) program is a not-for-profit organization founded by Dean Kamen in 1989 to promote career opportunities in science, technology, engineering, and math in children grades K-12 (Kamen, 2009). The fundamental goal of this organization is to "design accessible, motivational programs that combine team work, competition, and just plain fun to help build self-confidence, knowledge, life skills, career paths, and a sense of "Gracious Professionalism™" (USFIRST, 2011). The organization began with their first robotics competition in a high school gym with 28 teams in 1992 and have grown today to include over 160,000 children from all fifty states and seven countries (USFIRST, 2011).

One of FIRST's partnerships, University of Idaho (U of I) Extension's Idaho ROKS™, administers the FIRST LEGO® League program for the state of Idaho. Idaho ROKS™ (Robotics Opportunities for K-12 Students) was developed through U of I's

Extension State 4-H program in response to the goal of the National 4-H Science, Engineering, and Technology (SET) Initiative. The initiative was launched in the 2008 in response to America's decline in preparing young people for careers in technology, science and engineering. As reported by the National Center for Educational Statistic "34 percent of fourth-graders, 30 percent of eighth-graders, and 21 percent of twelfth-graders performed at or above the Proficient level in science in 2009 (NCES, 2009, p. 1). According to the National 4-H council "a mere 5 percent of current U.S. College graduates earn science, engineering, or technology degrees compared to 66 percent in Japan and 59 percent in China" (National 4-H Council, 2010, para. 1). FIRST, Idaho ROKS™, and SET all have the same goal to prepare and inspire children to choose careers in the fields of science, technology, and engineering. However, providing the opportunities for children through these programs do not necessarily indicate that children acquired life skills. Therefore, it is necessary to evaluate the effectiveness of these programs using rigorously tested and validated instruments on life skill development.

It is my intent to contribute to the efforts of measuring the impact of high quality youth development programs such as FLL and to gain information on how to further promote the life skill development of youth engaging in FIRST LEGO® League ages 9-14. Therefore, the purpose of this study is to measure six life skill outcomes of children ages 9-14 engaged in the state tournament for the FIRST LEGO® League program for the state of Idaho.

Overview of Methodology

I hypothesized that Life Skill development of youth ages 9-14 will increase due to the treatment of the FIRST LEGO® League program. The following questions were used to guide this research study: 1) Is there a change in participant's perceptions about their of life skills from the start of their participation in FIRST LEGO® League when compared to the completion of the program?; and 2) What do participant responses in a focus group exploring their life skill development reveal about their perceptions of the life skills they developed as part of their participation in the FIRST LEGO® League program?

The instrument utilized to conduct this evaluation was developed using the Washington State University Cooperative Extension 4-H youth Development Program web-based evaluation tool development utility. The web-based evaluation tool development utility was validated for program participants ages 12-adult (Bailey & Deen, 2002). This evaluation tool was created by the extension system to specifically measure the impact of their programs on life skill development of participants; therefore was ideal for developing a measure of life skill development of FLL participants. As a result, I developed and validated a life skills instrument for children ages 9-12 with a Cronbach's Alpha of .89 (Luckey & Nadelson, in press).

The subjects of this study include participants (n = 114) ages 9-14 of the state tournament for Idaho's FLL program for the 2009-2010 season. The research methodology includes a mixed methods pre-experimental design incorporating quantitative measurements using a paired samples test and qualitative measures utilizing a single-category focus group methodology for triangulation purposes.

Definition of Terms

Various terms in this study such as *instrument* and *indicator* are subject to multiple meanings based on the field from which it is derived. For example, the Life skill evaluation tool used in this study may be considered an assessment in the field of education or an instrument in research. The constructs *youth development*, *life skills*, and *life skill development* are subject to various interpretations. Therefore, creating a need for operational definitions for the various terms utlized in this study is necessary.

When addressing the terms for the evaluation of life skill development, the instrument being used for this study is called the Life Skills Evaluation Tool (LSET). The instrument is also refered to as the FIRST LEGO® League Life Skills Survey. The LSET uses 15 life skill outcome indicators. When reviewing the literature the construct *life skill outcome indicator* was used prolifically but not operationally defined. Therefore I investigated various definitions to identify and create an operational definition for this study. As a result of my search I discovered the following defnition for *indicator* from Dictionary.com (2011), a "device for showing the operating condition of some system." From *Indicators: Definition and Use in a Results-Based Accountability System,* Horsch (1997) defines an indicator as "measur(ing) inputs, outputs, and outcomes" (para. 3). She continues by providing a definition of outcome indicator as a "measure(ment) of the broader results achieved through the provision of goods and services" (para. 4). Based on these definitions and purposes of the LSET and this study the operational definition of the construct *Life Skill Outcome Indicator* is a statement indicating the measurement of a life skill due to an individuals participation in an activity.

Youth development has been considered a term vaguely defined amoung various agencies thereby weakening the case for attention by policy makers (Benson & Pittman, 2001; Pittman,1993). In recent years it continues to lack a universal definition as stated by *Building Partnerships for Youth* who after conducting an extensive literature review, created a framework of 21 essential elements of youth development (2009). However, for the purposes of this study the following definition from *The Center for Youth and Policy Research* will be used:

> ...the ongoing growth process in which all youth are engaged in attempting to (1) meet their basic personal and social needs to be safe, feel cared for, be valued, be useful, and be spiritually grounded, and (2) to build skills and competencies that allow them to function and contribute in their daily lives." (Pittman, 1993, p. 8)

Life skills are defined as "skills that help an individual to be successful in living a productive and satisfying life" (Hendricks, 1996, p. 4). The goals of many youth programs include creating opportunities for participants to experience the practical application of life skills so they may develop in these areas and become more readily able to utilize the skills later in life. For example, the National Cooperative Extension System, has developed a life skills model organized around the "4-H's" which are Head, Heart, Hands, and Health. These categories are embedded in the "Targeting Life Skills Model" (see Appendix A) as developed by Patricia Hendricks (1996) of the Iowa State University Cooperative Extension Service. These were developed with the notion that youth can be engaged in a wide range of beneficial and productive activities that encompass several life skills; it is the job of the practitioner to determine which life skills are most relevant and salient, and then evaluate their achievement accordingly (Hendricks, 1996).

CHAPTER 2: LITERATURE REVIEW

In this chapter, I will present theoretical (see Appendix B) and empirical literature regarding the measurement of life skill development in youth. First, I will build a foundation for my argument by presenting an overview of pre-adolescent and adolescent development and how it relates to life skill development and the goals as measured by the instrument in FLL. Second, I will proceed to build on the case by presenting literature on Positive Youth Development (PYD) and how PYD has informed the creation of the constructs of life skills. Third, I will continue to set the stage by sharing the empirical literature on the impact of the field of PYD on youth for the significance of developing life skills. Fourth, I will round out the argument by briefly presenting the literature on life skill evaluation tools and the measurement tool chosen for this study, thereby setting the case that this measurement tool as a reliable and valid instrument.

Pre-Adolescent to Adolescencent Life Skill Development

Before discussing and/or investigating life skill development in youth in their pre-adolescent (ages 9-11) to adolescent (12-17) stages, it is important to review how a child thinks in relation to their world. As a practitioner in education and a researcher of life skill acquisition, understanding how a child's mind operates at the various points of his or her growth dictates how to effectively measure life skill development. No literature currently exist that links the theoretical stages of development to the life skill construct. Therefore, the following section will present the six life skills being measured in this

study and the youth development theoretical support of these constructs. For complete definitions for terms and the interrelationship of FLL objectives and the life skill constructs see Figure 1 in Appendix C.

Based on the theory of youth development of children ages 9-14, it may be reasonable to measure the life skill acquisition of these life skill constructs of children in the pre-adolescent to adolescent stages of development. According to Erick Erikson's theories of social development (Erikson, 1968), children ages 9-12 are operating in the stage called "Competence". At this stage children can be expected to be more willing to share and cooperate with others. They also are ready to form moral values and recognize cultural and individual differences (Allen & Marotz, 2007) which may contribute to the development of communicating and leading others proficiently.

The team environment provided by FLL programming allows participants to develop the life skills *Communication* and *Leadership* through the practice of effective communication and leadership skills with teammates and with others through opportunities to assist one another by working toward a common goal. Participants may be taught explicitly by coaches and mentors how to interact with teammates and competitors in the spirit of FIRST's values of *Gracious Professionalism*™ and *Coopertition*™ (Kamen, 2009). *Gracious Professionalism*™ is a term created by Dr. Woodie Flowers, FIRST Advisor, as performing in a way that encourages high-quality work, emphasizes the value of others, and respects individuals and the community (para 2). At FIRST, *Coopertition*™ is displaying unqualified kindness and respect in the face of fierce competition (para. 5) These values involve sharing ideas with one another,

communicating ones ideas even under stress or frustration in a kind and respectful manner, and learning from others whether they are a competitor, teammate, mentor or coach.

During the ages of 9 to 10, children may have difficulty visualizing their future self. However, the age of 11 to 14 is a time when adolescents' reflection on their future choice of career is, according to Berk (2005), a central part of identity development. These stages of development may contribute to the development of the life skill *Useful/Marketable skills* differently depending on a child's progression in development. This is a life skill that the instrument may reveal little to no growth in younger participants as they may not be developmentally ready to be reflective about their future self. In FLL, even younger participants learn useful and marketable skills by building a presentation of their project and learning how to present their ideas to judges. They learn also how to work effectively as a group by developing their professional communication skills and through interviews on their presentations and technical design of their robots. These are skills that would contribute to their success in their future careers.

The ages of 9 to 14 is a time when children begin to develop moral reasoning and adopt the social customs and moral values of their society (Katz & McClellan, 1997). They also begin to "understand the need to assume responsibility for their own behavior and that there are consequences associated with their actions" (Allen & Marotz, 2007, p. 211). These developmental mile stones may contribute to the acquisition of the life skill of *Self-Responsibility* as they may learn how to be accountable for their own behavior and choose for themselves what is right or wrong. FLL provides opportunities for participants

to practice being held responsible for actively contributing as a member of a team. This includes consistently attending team meetings, being prepared for assigned work, and staying on-task during work periods.

According to Piaget's developmental theories, children from ages 7 to around 11 tend to operate in the *Concrete Operations stage* (Boeree, 2006). Children in this stage gain a better understanding of mental operations. Children begin thinking logically about concrete events, but have difficulty understanding abstract or hypothetical concepts (Piaget, 1959). Participants around the age of 12 and older tend to operate in the "Formal Operations" stage, allowing them to move from logical concrete to abstract thought (Boeree, 2006). Children moving into this stage of cognitive development may have the ability to systematically solve a problem in a logical and methodical way and are often able to quickly plan an organized approach to solving a problem (Piaget, 1959). They tend to like "challenges in arithmetic but may have difficulty understanding mathematical relationships in complex operations" (Allen & Marotz, 2007, p. 201). However for children 13 and older, they are becoming increasingly able to understand more abstract problems as they are continuing into the formal operations stage of development. The life skill *Critical Thinking* may when measured, show growth in participants ages 9 to10 but may be emerging as they approach the age range of 11 to 12. Regardless of where a participant is on the continuum of development, participating in the FLL program provides continuous opportunities to develop problem solving and critical thinking skills. FLL participants develop these skills by working together with their teammates to construct a robot and program it to navigate a playing field for points in competition.

They also must conduct a research project in relation to the theme, which changes from year to year, and present an innovative idea that contributes to the field of science, technology, or engineering.

According to Erikson's (1968) stage of competence, ages nine to eleven, begin to compare their self worth to others and can notice a difference in their abilities as compared to other children (Erikson, 1968). This is a stage of development when adults can foster the development of the life skill *Positive Identity* in youth by providing them with opportunities to develop new skills and use them in ways to contribute positively to others. "As children work on joint projects and help in their communities, they gain in social and moral maturity" (Berk, 2005, pp. 588-589; Killen & Nucci, 1995; Vandall & Shumow, 1999). In FLL the team atmosphere and mentorship provides these opportunities of growth in establishing this positive identity through team work and friendly competition.

Furthermore, the development of their self concept is largely influenced by their interactions with others (Berk, 2005). FLL is a challenging and, at times, rigorous experience for youth due to the intensity and duration of the time spent solving challenging problems during each meeting session. This intensity and challenge within a team environment is intended to provide participants with experiences identifying strengths and limitations they may have and understanding how to overcome those limitations and challenges with the guidance of mentors and coaches.

Taken together, the life skills I have chosen to measure are emphasized in the various facets of the FLL program (see Appendix C). The theoretical application of each

life skill nicely dovetails with the vision and mission of FLL. Therefore, measurement of the individual life skill indicators should give a reasonable evaluation of the intended purpose of the FLL program itself.

Positive Youth Development

Positive Youth Development (PYD) is defined as a field that focuses on young people's strengths, skills, and possibilities (Benson, Scales, Stephen, & Sesma, 2006). The field of youth development incorporates the theoretical ideas about adolescent development and the findings about the pathways children take through adolescence to formulate the framework known as PYD, which views young people as resources to be developed rather than as problems to be managed (Damon, 2004; Lerner & Lerner, 2008; Lerner, 2005). PYD research suggests that directly targeting the development of youth and teaching constructs such as developental nutrients, life skills and/or assests have positive and additive effects to their growth and well-being. The following are examples of this research.

The Search Institute compiled the core hypotheses of youth developent and their implications for policy and practice (Benson et al., 2006). This document compiled the research that supports the practice of targeting and supporting youth development. One of the hypotheses addressed was that changes in contexts change youth, and that we can intentionally change young people's context(s) to enhance their developmental success (Benson et al., 2006). The research supports the efficacy of intervention or prevention programs in providing youth with experiences that facilitate developmental outcomes

(Benson et al., 2006). Such research includes strengthening youth development through community service (McLellan & Youniss, 2003) and exploring the power of changed contexts on personal change and developmental success due to positive youth development programs (Benson et al., 2006; Rhodes, Grossman, & Resch, 2000; Tierney, Grossman, & Resch, 1995).

A review of the University of Washington's Social Development Research group in 2006 identified 25 out of 161 positive youth development programs that had significant impact on behavioral outcomes. The 25 programs had addressed at least 8 of the 15 "developmental assets" as identified and defined by the research group and 19 of the 25 programs demonstrated significant effects on positive youth development outcomes. Of the 25 programs, 24 of them showed significant reductions in problem behaviors such as alcohol and other drug use, school problems, aggressive behavior, violence, and risky sexual behavior (Benson et al., 2006; Catalano, R. F., Berglund, L. M., Ryan, J. A., Lonczak, H. S., & Hawkins, J. D., 2004). The research on intervention and prevention programs indicate that youth development interventions do make a difference by strengthening adult-youth relationships, establishing social norms around desired youth behavior, learning social competencies, and providing youth opportunities for involvement and leadership (Benson et al., 2006).

Additional literature points toward evidence that building developmental assets has an impact on youth at the time of the intervention and has successive additive effects over time (Benson et al., 2006). A two year longitudinal study on adolescent development conducted by Way and Robinson (2003) on 100 low-Socio-Economic Status (SES)

Hispanic, African American, and Asian adolescents showed that an increase in self-esteem was greater over time in students with less family support than those with support. They also found that there was a reported decrease over time of depressive symptoms of students with less family support than those with more. The results of this study showed evidence of "perceived school climate was associated significantly with the magnitude of change in self esteem, over and above the effects of family and friend support" (Way & Robinson, p. 339).

Youth development programming can provide a wide variety of opportunities for children ages 9 to 14 to develop life skills (Lerner & Lerner, 2008). The following research verifies the ability to use life skill evaluation tools to measure the construct development in this population.

Life Skills Evaluation Tool

Doris Loeser (2004) and colleagues from Montana State University conducted a pilot study of developmental abilities in children ages 8 to 11 were investigated in relation to taking a self-reporting life skills evaluation tool. This study used the web-based Life Skills Evaluation System created by researchers at the Washington State Cooperative Extension System and examined the validity of this instrument on children in third through fifth grades. The study was piloted with 65 youth attending a four-day 4-H camp. The evaluation tool consisted of 31 life skill indicators that addressed the following six life skills: *Decision Making, Wise Use of Resources, Communication, Accepting Differences, Healthy Lifestyle Choices,* and *Self-Responsibility*. The internal

reliability resulted in an Cronbach's alpha of .81 indicating a good level of instrument reliability (Loeser, Bailey, Benson, & Deen, 2004).

Loeser (2004) also chose to conduct a seperate pre-test and post-test prior to and following the camp program. The web-based evaluation tool was orginally designed to administer the pre-test and post-test following the program completion (Bailey & Deen, 2002). However, the researchers chose this method of adminstration due to the limited abstract reasoning skills of the younger participant ages 8 to 11 (Loeser et al., 2004; Piaget, 1959).

Washington State Cooperative Extension created the Life Skills Evaluation System (Bailey & Deen, 2002). The Life Skills Evaluation System is an item bank developed to allow access to valid items that could be compiled to develop instruments used to evaluate youth life skill development. The system provides a means for testing the assumption that Cooperative Extension 4-H Youth Development and Family Living programs teach life skills and provides a method for creating valid and reliable instruments that could measure growth in life skills that individuals may experience from their participation in extension programs.

In a previous study, I utilized the evaluation system to develop an instrument to evaluate the life skill development of children 9 to 12 years old participating in 4-H Summer Day Camps for Boise, Idaho's Ada County Extension Youth Program. The instrument was intended to measure the life skill development of youth ages 9 to 14 participating in youth based programs. The life skills instrument had thirty life skill indicators split into two forms. Each form had 15 indictors that measured all six life skills

(see Appendix D). When data collection was completed, the resulting working sample sizes were $N = 41$ for Form A, and $N = 47$ for Form B. The reliability analysis of the responses on Form A, $N = 41$, to the 15 indicators revealed a Cronbach's Alpha of .89 and Form B, $N = 47$, had a Cronbach's Alpha of .88. This life skills evaluation tool for participants ages 9 to 12 was determined to be an effective measurement of life skill outcomes using the WSU Cooperative Evaluation System repository for the following life skills: *Communication, Leadership, Useful/Marketable Skills, Self-Responsibility, Critical Thinking,* and *Positive Identity*. Participant responses to open-ended prompts and our interview data corroborate our conclusion that life skill development of children ages 9 to 12 can be successfully assessed. Further, since our data was drawn from participants engaging in a range of programs promoting life skill development there is indication that the items may transcend context and assess the constructs independent of the specific experience.

CHAPTER 3: METHODOLOGY AND DESIGN

Research Questions

The goal of this research is to measure the life skill development of Idaho FLL participants' ages nine to fourteen years old. The following research questions will guide this investigation:

1) Is there a change in participant's perceptions about their of life skills from the start of their participation in FIRST LEGO® League when compared to the completion of the program?
2) What do participant responses in a focus group exploring their life skill development reveal about their perceptions of the life skills they developed as part of their participation in the FIRST LEGO® League program?

Data Collection and Analysis Methodology

Participants and Recruitment

The University of Idaho Extension conducts youth development programming for children ages 6-18. One of the modes of program delivery is through the Idaho Robotics Opportunities for K-12 Students (Idaho ROKS™). Idaho ROKS is the Affiliate Partner with FIRST and is responsible for managing the FIRST LEGO® League programs in Idaho. The FLL season is from September to January. FLL teams meeting durations and locations vary according to the availability of teammates and coaches. In general, FLL in

Idaho is conducted through school based programs, home based, and/or community based organizations. Children are invited to participate in FLL and are self-selected.

Participants in this study include children grades 4^{th}-8^{th} (ages 9 to 14) that have qualified through a regional qualifying tournament to be invited to participate in the 2010 FIRST LEGO® League state tournament located in Pocatello, Idaho. The demographic information for the FLL program, its associated events, and participants involved in this study can be viewed in Table 1 below. Focus groups consisted of 35 female and male participants ages 9 to 14. Further demographic information was not recorded. However, comparing the demographical information, I feel the participants in this study are representative of the participants in the FLL state wide program.

Table 1

Demographic Statistics for Idaho State FLL Participants

Demographic Information	FLL Qualifying Tournament Participants	FLL State Tournament Participants	FLL Life Skills Outcome Survey Participants	Focus Group Participants
N	1,114	349	114	35
Female	33.59%	37.43%	38%	37%
Male	67.41%	62.57%	59%	63%
Ages 9-11	54.83%	64.33%	47%	51%
Ages 12-14	45.98%	38.01%	50%	49%
Caucasian	93.19%	94.74%	84%	-
Hispanic	5.53%	3.68%	1%	-
American Indian	5.31%	0%	-	-

(table continues)

Table 1 (continued)

Demographic Information	FLL Qualifying Tournament Participants	FLL State Tournament Participants	FLL Life Skills Outcome Survey Participants	Focus Group Participants
African American	1.08%	.53%	0%	-
Asian American	-	-	1%	-
Racially Mixed	-	-	9%	-

Design

Combinations of methodologies were used to gather both quantitative and qualitative data. The use of a combination of methodologies is chosen for the purposes of triangulation which "seeks convergence, corroboration, and correspondence of results' across the different methods and will be used to increase the validity of constructs and inquiry results by counterbalancing known method biases and limitations"(Green, 2001, pp. 252-253). The quantitative methods included using a paired samples test to compare pre and post-composite instrument responses, verified the reliability of the instrument using a Cronbach's alpha analysis, and compared pre and post test mean scores for each life skill indicator to identify life skill growth. The qualitative portion of the study involved conducting a single-category focus group design with three focus groups with a total of 35 participants to triangulate results and provide further support for the measurement of life skill acquisition.

Procedures

Using the instrument I previously validated (Luckey & Nadelson, in press), I measured the life skills of FLL program participants for the state of Idaho. The instrument is a retrospective pre/post test design consisting of 15 life skill indicators with a four point Likert scale (see Appendix D). The instrument was emailed to Idaho State Tournament qualifying teams as part of the registration material to be completed and returned to the registration table during a designated time frame on the opening day of the tournament. Detailed instructions on how the test was to be administered by coaches were provided as well as a script from which they were to follow (see Appendices D and F).

On the opening day of the state tournament I participated in collecting forms and life skill evaluation tools at the events registration table. Many teams participating were traveling from out of town and showing visible signs of excitement, anxiety, and fatigue. Teams had a challenging day of competition and navigating through a tightly scheduled day of four events. Due to the events all being scheduled in one day, teams only had between a one hour and one hour and 30 minute break for lunch in the afternoon with no other breaks. As I collected the LSETs and other forms, many teams stated they had completed the forms but forgot them or lost them while traveling. Others had computer issues when faxing the forms to the tournament, while other teams chose not to complete the LSET because they ran out of time. Therefore, of the 349 state tournament participants, 114 instruments were submitted and complete. I encouraged and solicited teams that did not complete, misplaced, or forgot their LSETs to do so and provided additional instruments to be completed. Due to the constraints on coaches and

participants teams opted not to complete the instrument nor did they want to take them and return them at a later time or date.

To triangulate the quantitative data, I conducted three focus group discussions using a single-category research design with a select group of participants representing each age group participating in the state FLL competition. Participants were selected by means of a "Piggy-Back Focus Group" strategy (Krueger & Casey, 2000). Piggy back focus groups occur when the "participants are gathered for another purpose and the focus group is held during free time, during a meal, or after hours so as not to interrupt the primary purpose of the gathering" (Krueger & Casey, 2000, p. 75). A protocol/script (see Appendix G) was utilized to conduct the focus group and participants were audio recorded. I conducted the focus groups and informed participants that participation was voluntary and they may decline participation at any time. Participants were also informed about the study and that they would be audio recorded.

Establishing Consent and Assent

I arranged with the 4-H Youth Development Specialist from the University of Idaho Extension Services, Dr. Tim Ewers, to email consent/assent forms and the life skills outcome instrument for the participants and their parents to sign, complete, and return at the state tournament registration table along with all of their other registration forms. One week prior to the state tournament, Dr. Ewer's sent out an email reminding state qualifying participants to sign and return the documents at the registration table at the state tournament. I was present at the state tournament registration table to collect

consent/assent forms, over see the collection of the surveys, and answer any questions about the study.

While at the registration table I invited consenting and eligible participants to participate in a focus group at the state tournament. The appropriate parent permission forms and assent forms were collected on site prior to the interviews. The focus group discussion was conducted during lunch between competition events to celebrate and allow participants to share their learned experiences and life skills gained due to their participation in FLL. Each focus group consisted between 8-18 participants, ages 10-14, and lasted between 20 -30 minutes. Focus group interviews took place on the Idaho State University campus on January 16th. I developed and used a focus group protocol/script (see Appendix G) to conduct the focus group discussion.

Data Collection

Quantitative. Collection of the quantitative data involved the following procedures. First, I arranged with Dr. Tim Ewers to have the life skills evaluation tool (Luckey & Nadelson, in press) and consent/assent forms (see Appendix E) included in the required documents for the state tournament. Secondly, consent/assent forms, life skill evaluation tools, and instructions were sent out to participants via email in the FLL Tournament handbook (see Appendix F). Written in the tournament handbook were instructions to complete and return all forms at the state tournament to the main registration table. On January 16th from 7:30am-8:30am at the Idaho State FLL

tournament in Pocatello, Idaho, I worked at the registration table collecting team forms, including consent forms and life skills evaluation tools.

Qualitative. For the qualitative portion of this study, I conducted three focus groups. While working at the registration table I solicited teams to participate in a focus group. I asked coaches the number of participants on their teams and their age groups. I was seeking teams that reflected the age groups and various levels of heterogeneous and homogenous groupings present in teams representing the Idaho State FLL program. Based on the make-up of the team I invited them to participate in a 30 minute focus group session and offered lunch in return to the coaches and participants for their participation. I selected a classroom centrally located for easy access for participants and coaches.

Four teams participated in three focus group sessions. Focus group B consisted of two teams and had a total of 18 participants including 9 females and 9 males with an age range of 10 to 14 years old. Focus group C consisted of one team of 9 male participants' ages 9 to 10 years old. Focus group D consisted of one team of 8 participants including 4 females and 4 males with ages 9 to 10 years old. The average time of the focus groups duration was 19 minutes and 33 seconds.

To maintain anonymity of the participants and determine the age and gender of each individual recorded during the interview, I created a system to record such information for future reference. I created a chart (see Appendix I) reflecting the age and number of position each participant spoke. The ages on the chart were color coded (i.e. blue = 9 year olds, red = ten year olds, etc.) and each interview participant was given a

corresponding colored sticker to wear on their shirt to represent their age. I solicited an adult chaperone from each focus group to record on the chart the age and gender for each participant that spoke during the interview.

During focus group interviews I began the interviews by introducing myself, explaining the purpose of the study and focus group, and an explanation of how the focus group was going to proceed. While audio taping participants I began interviewing them following the focus group protocol/script. As I interviewed participants I at times I found it necessary to repeat questions and/or restate the questions in a different way to encourage responses from participants. Focus groups B and D would occasionally need a repeated question or rephrasing of a question. When interviewing Focus group C I had to repeat and rephrase questions frequently to get a response from the participants. Occasionally even the repeat and rephrasing of a question was not sufficient to stimulate a response from Focus group C participants. Even though I felt it would be beneficial to provide additional questions and /or examples, I adhered to the script due to institutional review board regulations.

Organizing and Preparing Data for Analysis

Quantitative. To prepare the quantitative data for analysis, I had the collected life skills instrument data entered into an Excel program. Using the Excel program I was able to organize and sort the data for entry into a computer based statistical program to perform further analysis. I then conditioned the data which included replacing missing values. The resulting work sample size was $N = 114$.

Qualitative. For the qualitative portion of the study, the evening following the completion of the focus group interviews, I wrote detailed recollections about the process of conducting the interviews including my initial observations about each focus group. I then had the interviews transcribed and then personally edited and rechecked the accuracy of the transcripts while listening to the interview records. In order to identify the age and gender of each interview participant, I used the color coded age/gender chart and while listening to the audio recordings and reading the transcripts I identified the age and gender of each participant in the order they responded. Once the age and gender of each participant in the interviews was determined, I began the process of coding the transcripts.

Coding

Quantitative. The life skills instrument was designed to be best understood by participants ages nine and older. In order to make the Likert scale more appealing and understood by younger participants, icons representing feelings were used. For example, the icon representing "Never" on the instrument was a sad face (see Appendix D). Therefore, prior to data entry, the icons were coded using the typical Likert numeric representations (i.e. "1" represented "Never", "2" represented "Sometimes", etc.).

Qualitative. I began the process of coding the transcripts by assigning a color to each life skill making the resultant apriori codes for this study (see appendix H) to then use to highlight participant responses about each life skill. Before I began highlighting, I further defined the codes I would use to determine if a life skill was evident by

participant responses. Therefore I used the life skill indicators from the LSET to guide the process of identifying evidence of participants experiencing life skills in FLL. For example there are two indicators used in the LSET to measure the life skill *Communication*. Using the first indicator "I can make a presentation" I read through the transcripts and highlighted in purple any responses by participants that indicated they had made a presentation. I continued this process with each life skill indicator until I had coded the transcripts using all the indicators from the LSET as my codes.

To establish the interrater reliability (Creswell, 2009) for my coding I asked two experienced researchers to code the transcripts for focus group B. Initially I prepared and provided detailed instructions on the process of coding the transcripts, the definition of each life skill, the indicators used for each life skill, a copy of transcript B, apriori codes, and highlighters. I mailed the instructions and information to my volunteers and once they completed the process they mailed the coded transcripts back to me. Then I conducted the processes of interrater reliability and discovered that this process of coding provided an interrater reliability of 68%. I decided the method of coding lacked direct face to face communication and discussion with my fellow coders. Therefore we each had differing understandings about what would be considered a good representation of each life skill indicator. I also discovered that as we coded the transcripts some of the participant responses were perceived to be examples for up to four indicators. Since I was not seeking to identify emergent themes in this study I created subsets within the transcripts by the script sections that were written for each specific life skill. For example, in the transcript it is noted which student spoke and at which order signified by

ST1 was the first participant to speak, ST2 as the second speaker, etc. Therefore, the section of the transcript that targets the life skill *Communication* was from ST1 to ST9.

I again asked one of my volunteer coders to meet with me and recoded the transcripts using the following process. Starting with the transcribed subset section on *Communication*, I provided detailed instructions on the procedure of coding the transcripts to my volunteer coder. First, I provided the definitions for the life skill to be coded and the indicators that were used in the life skills assessment for the life skill *Communication.* Then we discussed what would be evidence of that life skill using the indicators as codes (see Table 2).

Table 2

Codes Used to Identify Participant Responses of Acquired Life Skill Development

Life Skills	Indicators (Codes)
Communication	1. Make a presentation. 2. Listen carefully to what others say.
Leadership	1. Organize a group to reach its goal. 2. Get others to share in leadership.
Useful/Marketable Skills	1. Work out problems that are presented to me. 2. Contribute as a member of a team. 3. Accept responsibility for doing a job.
Self-Responsibility	1. Do what is right for me when with a group. 2. Admit to mistakes I make.
Critical Thinking	1. Try doing activities more than one way. 2. Use other things I know to solve problems. 3. Think of new ideas after doing an activity.

table continues

Table 2 (continued)

Life Skills	Indicators (Codes)
Positive Identity	1. Enjoy using my skills. 2. Do things for myself or others. 3. Decide what I want to do.

We began with the first indicator "I can make a presentation" and discussed what types of responses would be evidence that a participant had an experience making a presentation and learn something from the experience. We then preceded separately to underline the passages or phrases that showed evidence of this indicator. Once we were both finished with the section of the transcript on *Communication*, we continued with the same process with the remaining five life skills under investigation. Once the codings were completed we had an interrater reliability of 93%. I preceded the process of coding the remaining transcripts using the procedures established from the second round of establishing the interrater reliability before conducting my data analysis.

Data Analysis

Quantitative. When analyzing the quantitative data, I verified the reliability of the instrument using Cronbach's alpha analysis. Calculations for both the pre and post test Cronbach's coefficient alpha analysis were .85. These calculations were close to the value of the reliability analysis of the original validation study (.90). I then utilized a repeated measures t-test with the dependent variable being the acquisition of life skills and the independent variable being FIRST LEGO® League.

Qualitative. For the qualitative portion of this study I conducted a pilot focus group with a FLL team to refine the script's questions. The pilot focus group was conducted on December 17th with *N* = 10 participants ages 9 to 12. I made modifications to the protocol and/or script to use for this study (see Appendix G).

To further prepare the qualitative data for analysis I used the "Long-Table Approach" (Krueger & Casey, 2000) as a "means of systematically cutting, sorting, and arranging through comparing and contrasting the data" (p. 137). Instead of using an actual table, I used the Microsoft Excel software program to manage and sort the data. The steps I conducted in this analysis process are as follows:

1. First, I cut and pasted the participant responses into an Excel sheet including the focus group, participant response number, and age of each participant response.
2. Second, I color coded each life skill based section based on the aprior code chart. For example, all responses in each focus group pertaining to the life skill "Communication" were color coded as purple and assigned the number "1" in a column in Excel to designate those responses as "Communication" for sorting purposes. I then continued this process for each section of responses for each life skill. This enabled me to sort all focus group responses into categories according to the life skill investigated.
3. Third, I created an excel page for each life skill in order to further sort and categorize the participant responses.

4. The fourth step in the "Long-Table Approach" involved categorizing the participant responses according to the following questions:
    - Did the participant answer the question that was asked?
    - Does the comment answer a different question in the focus group?
    - Does the participant response say something of importance about the topic?
    - Is the response like something that has been said earlier?

Once I categorized the responses according to these questions, I then sorted responses based on the frequency of the type of response, how specific the responses were on a life skill, the emotional intensity of the participant responses, and the extensiveness of the responses or rather how many different participants responded similarly (p.136).

I refined my sorting by creating additional columns as I read through the participant responses indicating new categories as they presented themselves in the data. For example, as I looked through the responses of participants pertaining to *Communication* I noticed two categories emerge which included responses that I then classified as responses pertaining to making a presentation and listening. Next, I wrote a description of the participant response with two or three selected quotes used as evidence to capture the essence of what was said. After completing one life skill, I continued in the same process with each life skill. As I worked through this process I discovered reoccurring ideas that were represented in participant responses across the six life skills investigated. I reexamined the data and reported those findings again with participant responses to serve as evidence.

To triangulate the quantitative data with the qualitative, I utilized frequency count methodology to compare the incidences of responses the participants provided for each life skill indicator. Using the coded data for each life skill indicator, I calculated the number of response incidences participants made for each indicator. I felt the number of response incidences did not provide a visual comparison of the data for discussion and charting purposes. So I calculated the percentage of participant response incidences for each life skill indicator. I felt a percentage was a better indicator of participant responses.

Next I wanted to compare each of the focus group response incidences to determine if there was a variation in the response incidences by each focus group. Using the participants' average percentage for each indicator, I found the average of the indicators' for each life skill for each focus group. For example, in the life skill *Communication* there were three indicators. Using the percentage of response incidences for each of the three indicators for focus group B, I averaged the three scores to create a standardize number to measure the incidences of responses for that life skill for focus group B. I continued using the same process for each focus group on each of the six life skills and created a comparison graph to illustrate the findings.

Finally, I presented the data from the qualitative and the quantitative data using the life skills instrument percentage gain and the response incidence for each life skill indicator. I created a graph and reported the resultant findings.

CHAPTER 4: THE RESULTS

In this chapter, I will present first the quantitative results on life skill development based on the statistical data from the life skill outcomes survey. Secondly, I will present evidence from the focus group interviews to answer the second question investigated in this study. Finally I will present the related findings of both methodologies.

Life Skill Outcomes Instrument Results

Instrument Reliability

I conducted a Cronbach's alpha reliability analysis on the life skill outcomes instrument. My calculations for both the pre and post tests of the LSET, $N = 114$, revealed a Cronbach's coefficient alpha analysis of .85. This calculation was close to the value of the reliability of the original instrument validation study which had a Cronbach's coefficient alpha analysis of .90.

Quantitative Results

My first research question asked: *Was there a change in acquired life skills due to FIRST LEGO® League participation from the start of the program as compared to the completion of the program?* To answer this question I conducted a paired-samples test to compare pre and post-composite instrument responses. The data revealed that there was a significant difference in the scores for pre-composite ($M = 2.93$, $S = .44$) and post composite ($M = 3.40$, $S = .03$) responses; $t\ (113) = 15.87$, $p < .01$. These results suggest

that due to the participation in FIRST LEGO® League a participant will have an increase in life skill outcomes. The correlation of the pre-composite and post composite scores of the life skills outcome instrument was significant, r (114) = .66, $p < .01$. This correlation may signify that the treatment of FIRST LEGO® League on participants increases their life skill outcome gain. The mean for the pre-composite scores of the life skill outcomes instrument was 2.93 (S =.44) and the mean for the post composite scores was 3.40 (S = .36). The increase of composite score mean from pre-test to post test indicates participants self-reported a gain in their life skill acquisition. The results provide further evidence of the efficacy of FIRST LEGO® League on participant life skill development.

My analysis continued by comparing the pre and post test mean values of the six life skills (see Figure 1). The highest percentage gains were in the life skills *Leadership* (25%), *Communication* (19%), and *Critical Thinking* (18%). The lowest gains were in *Self-Responsibility* (16%), *Useful/Marketable Skills* (15%), and *Positive Identity* (10%). These results are indicative of the stated FLL mission and values (see Appendix C). The three highest life skill gains are reflected in the FLL program's emphasis of the following: Shared leadership through teamwork; Communication, both through team driven tasks and research presentations; and the high level of critical thinking and problem solving opportunities participants are engaged in through the robotics competition's use of engineering and technology.

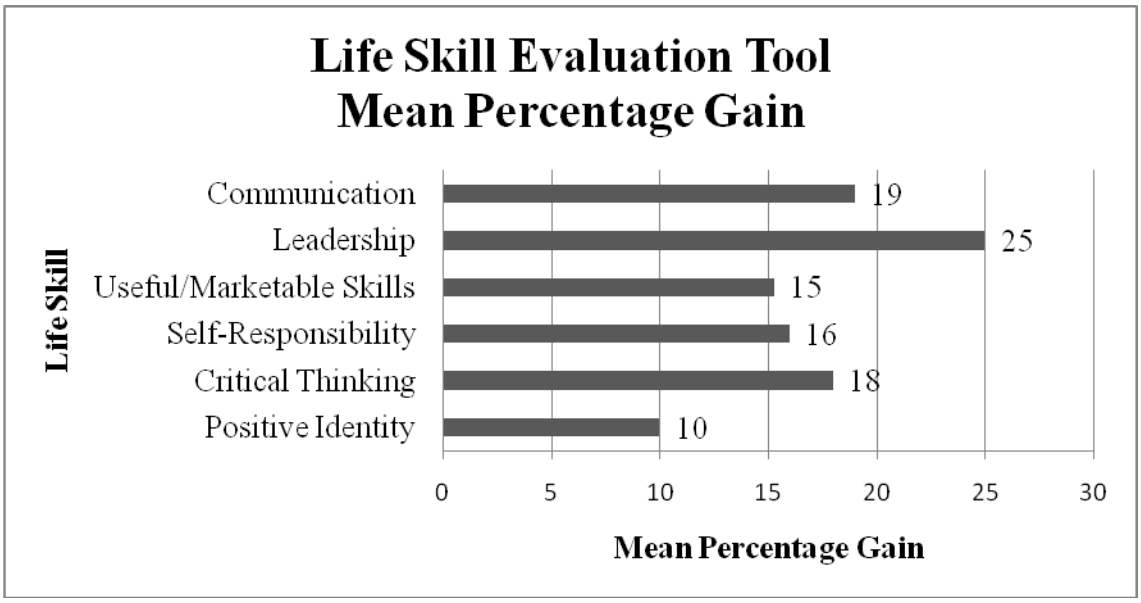

Figure 1. The life skill evaluation tool average percentage gain by each life skill.

I was then interested in investigating the life skill indicators that had the most and least growth. I examined the mean scores of the pre-test and post test and calculated the resultant percentage gain for each life skill indicator (see Table 2). The greatest gain was in the life skill *Leadership* (25%), but specifically in the indicator "I can organize a group to reach a goal" (32% gain). The least gain was in the life skill *Positive Identity* (10%) with the lowest gain in the indicator "I enjoy using my skills" (9%).

Table 3

Life Skill Evaluation Tool's Pre/Post-Test Mean Scores and Percentage Gain.

Life Skill Indicators	Pre	Post	Percentage Gain
I can organize a group to reach its goal.	2.35	3.10	32%
I can make a presentation	2.76	3.41	23%
I try doing the activities more than one way.	2.73	3.30	21%
I am able to work out problems as they are presented to me.	2.86	3.39	19%
I think of new ideas after doing an activity.	2.79	3.30	18%
I can get others to share in leadership.	2.57	3.03	18%
I admit to mistakes I make.	2.84	3.32	17%
I use other things I know to solve problems.	2.91	3.37	16%
I do what is right for myself when with a group.	2.95	3.40	15%
I listen carefully to what others say.	2.98	3.44	15%
I accept responsibility for doing a job.	3.13	3.56	14%
I can contribute as a member of a team.	3.36	3.78	13%
I do things for myself and others.	3.06	3.43	12%
I can decide what I want to do.	3.17	3.47	10%
I enjoy using my skills.	3.36	3.66	9%

The following chart indicates there was growth among participants due to the treatment of FIRST LEGO® League in all life skills indicators. The calculations of the LSET pre-test to post test composite values are presented in Figure 2. This chart reveals that the gain from pre to post test may be more representative of the Likert value participants provided for the pre-test than the overall gain from pre to post test (see Figure 1). Therefore, the highest percentage value is from participants self reporting when they began the FLL program with less experience with that particular life skill than

others. Conversely, life skill indicators with a lower percentage gain is reflective of the participants scoring the indicator higher than other life skills on the pre-test and not shifting substantially upon post-test due to a ceiling effect.

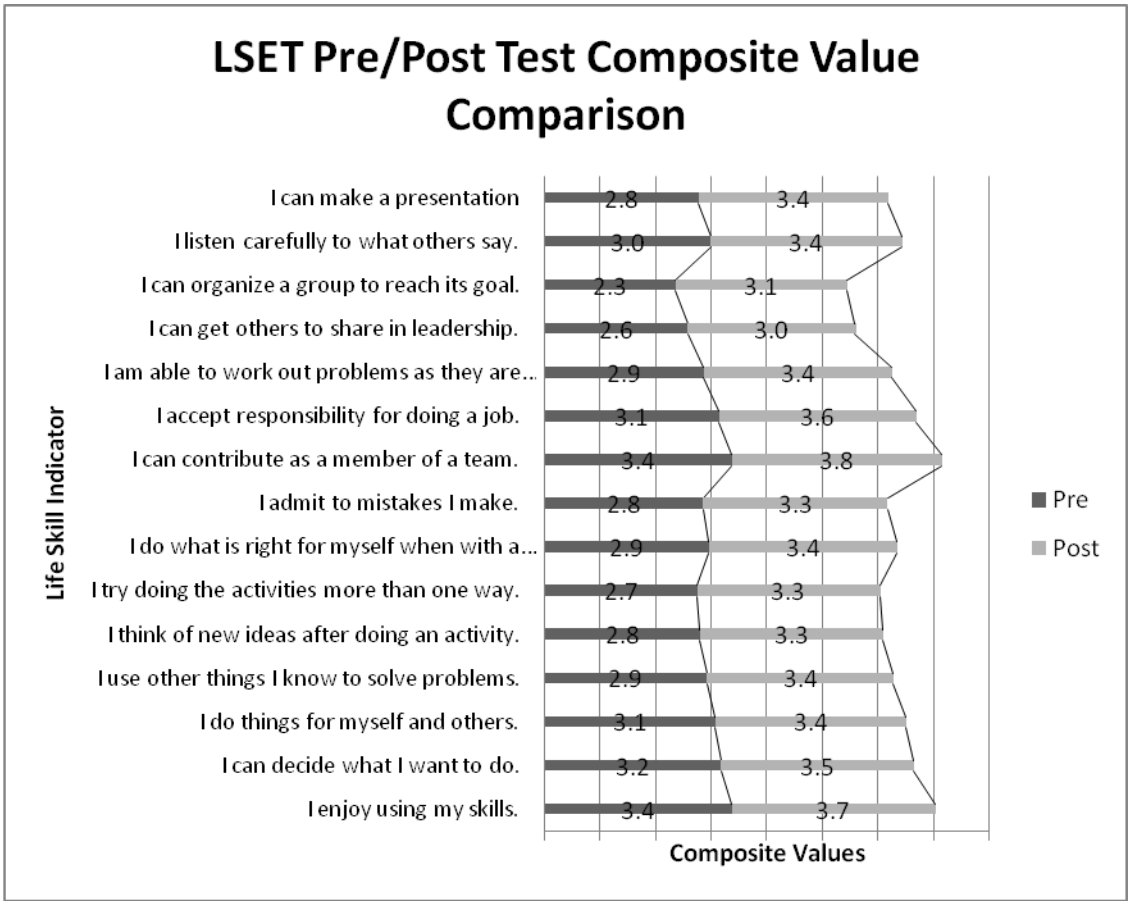

Figure 2. A comparison of the mean pre and post test composite values for LSETindicators.

Qualitative Results

My second research question asked: *What do student responses from a focus group setting about their life skill development reveal about the acquired life skills by the*

participants in the FIRST LEGO® League program? To answer this question I examined the transcripts of the participant responses to interview questions seeking indicators of life skill development. I will present the data sectioned by each life skill under investigation describing the evidence of each focus group and submitting evidence of their life skill acquisition. Next, I will share the anecdotal evidence from the interviews of participants by their age group and lastly describe what their responses reveal about their life skill acquisition overall.

Communication Skills. The life skill *Communication* is defined as: The exchange of thoughts, information, or messages between individuals using speech, writing, gestures, and artistic expression. When analyzing the data this definition presented coding complications due to the broad scope of the definition. Therefore I examined the data through the lens of the life skill indicators used in measuring the life skill *Communication*. Those indicators were: "Make a presentation", and "Listen carefully to what others say." I looked for responses that indicated the participants could provide an example of when they made a presentation or listened carefully to what others had said. There was evidence that participants conducted a research project and shared their ideas through a presentation. Participants shared examples of specific content they studied for their FLL research project such as, "I thought that thing with the aquifers was really cool. It's the size of Lake Eerie. It was (…) foot deep." They included comments on what they liked about the research project and shared some of the fun parts about their presentation in the following dialogue from Focus Group D:

> Interviewer: "Very good. What was your favorite part about making your presentation, your project?"

Participant 3: “No. (Everyone laughs). Um, the jokes.”

Interviewer: “So you had jokes in your presentation?”

Participant 3: “Yes.”

Interviewer: “Oh, I would love to hear those.”

Participant 4: “The jokes too.”

Interviewer: “Ok. How many of you liked the jokes? Is there anything other than the jokes? You all liked the jokes? Anything other?

Participant 6: “I liked doing research.”

Interviewer: “Oh really? What part of the research did you like?”

Participant 6: “Like just searching on the computer.”

Interviewer: “Yay. That is very fun to do.”

Participant 7: “On we pretended that a light bulb blew up the flag and we passed out some matches to the judges.”

Participants expressed the challenges of listening to one another saying, “Well sometimes it was difficult when we have different ideas about what to do” (Focus Group C, Participant1). Another participant shared their frustration when others in their team do not listen by sharing, “Sometimes other people wanna take over and they don’t let other people (…) do what they want” (Focus Group C, Participant2).

Participants’ responses also indicated their attempts to resolve conflict and make decisions as a group through previously agreed upon procedures. In order to be successful in this skill they must be able to listen carefully to one another and share their thoughts and ideas. One procedure was through voting:

> Focus Group D, Participant 2: "Sometimes we have, a, to do what they said. I mean like, not that, but it's kind of hard to decide on an idea, um, all together so you have to vote or something."

Several times participants indicated they resolved conflict or came up with a solution by communicating their ideas and, although challenging, finding a compromise:

> Focus Group B, Participant 6: "I think that we me when I met some people are stronger in other categories. So It's nice to have a variety of people spread out in your team. Like um (name) and me started working on a project and then we, I kinda went over to programming and um playing on the table.

> Focus Group B, Participant 3: "Well we practiced teamwork challenges and one of them was we had to build the tallest free standing structure and we had all different ideas but we had to stick to just one. So it was kind of difficult to choose which one."

While analyzing the data, a theme emerged that I labeled as "Resolve Conflict." There were ten responses in regards to the interview questions on the life skill "Communication" that did not fit into the following two indicators for "Communication." Those life skill indicators included: "I can make a presentation," and "I listen carefully to what others say." Rather they addressed the ability to resolve conflict when present. Some examples of those responses include:

> Focus Group B, Participant 8: You um just do one of the person's ideas and then if it really not the answers then do somebody else's idea.

> Focus Group C, Participant 6: Um, we went to the captain and said what, asked what he wanted to do.

> Focus Group D, Participant14: Taking somebody's idea and then putting a little bit of our own.

Leadership Skills. The life skill "Leadership" is defined as the ability "to assist a group in meeting its goals by showing or directing along the way; using personal influence to guide a group in reaching its goal. The life skill indicators in the life skill

outcome instrument include: “Organize a group to reach its goal” and “get others to share in leadership.” Using this definition and life skill indicators I began looking for evidence of growth in this life skill.

Participant responses indicate their ability to get others to share in leadership not only within their own team but also with competing teams:

> Focus Group B, Participant 17: “Depending on what category you’re working in you need share in who‘s the best in that”
>
> Focus Group B, Participant 15: “It’s helping other teams as well as yourself like giving a team other things that they need if you have them.”
>
> Focus Group B, Participant 16: “…if one of the other team’s robots if it breaks down and you have spare parts that they need and they didn’t pack their parts you can let them use some of your spare parts.”

When organizing their teams to reach a goal, teams identified leaders to dictate the roles for the group, assigned their roles through a voting process, or completed tasks based on what needed to be completed:

> Focus Group D, Participant 19: “In last of our tournament to get here um basically when we were doing the team work she’d say, “Who’s good at this part?” and then we’d raise our hand and she’d pick a few people.”
>
> Focus Group C, Participant 19: “Computer team leader and a robot team leader and a project team leader and we had a robot team leader but he quit and we haven’t elected one since. So I’ve been doing the robot mostly and so has (name) doing the robot so he is probably going to get elected. That’s probably who we are going to choose.”
>
> Focus Group C, Participant 10: “Um everyone was doing their, was doing the same thing. While each person had a job, each person did their job so at the end it would all come together and get what we found out our thing was.”

Useful/Marketable Skills. To have “Useful/Marketable Skills” is to have the abilities wanted by employers and needed to hold a job. The life skill indicators for this

life skill includes: 1) Work out problems that are presented to me; 2) Contribute as a member of a team; and 3) Accept responsibility for doing a job.

When examining the data on for how participants worked out problems presented to them, I noticed this was an area that was particularly difficult for participants. In the FLL program participants have tasks presented to them that they must accomplish including programming a robot, engineering the robot to complete tasks, researching and presenting a topic. With these tasks, teams are given instructions by their coaches, mentors, and/ or assigned team leaders. When I asked the participants if there were difficulties they had in following instructions Focus Groups C and D struggled with taking instructions when they wanted to do something different:

> Focus Group C, Participant 26: "Sometimes the coach told you to do something you didn't want to do and you didn't want to listen to the coach. You wanted to do your own thing."
>
> Focus Group D, Participant 40: "Sometimes another coach wanted to do something else with the robot."
>
> Interviewer: "Something else other than what the team wanted to do?"
>
> Focus Group D, Participant 40: "Yes."

Whereas Focus Group B struggled with taking instructions do to the amount of instructions and tasks that needed to be accomplished:

> Participant 22: "Um you really have to work together to find a solution if you didn't know because you have to…because there were so many instructions you really have to kind of get specific and you have get everybody's input in there and find a way to do it."

This group also discovered that taking instructions can be difficult depending on who is giving the instruction as exemplified in this dialogue:

> Interviewer: "What were some things that were difficult about following our instructions?"
>
> Participant 22: "Um you really have to work together to find a solution if you didn't know because you have to…because there were so many instructions you really have to kind of get specific and you have get everybody's input in there and find a way to do it."
>
> Interviewer: "Very fun. Ok one more."
>
> Participant 23: "On about taking instructions you have to disregard who is giving the instructions and think of them as your coach because it's hard to like say from your brother or something it's hard to take the instructions and take it seriously cuz they're a sibling."
>
> Interviewer: "So you're saying that sometimes you have to take instructions from a team member that might be the same age or friend or sibling."
>
> Participant 24: "Yea."

When participants were asked about examples of being team contributors and accepting responsibility for doing a job, Focus groups B and D provided evidence that they developed the ability to over look the emotional distractions of wanting their ideas to be used due to the importance of the task and the goals of the team:

> Focus Group D, Participant 34: "Don't argue about what you're doing (…) because what you're doing might be important."
>
> Focus Group B, Participant 18: "You stick in your two cents. You do what you know you need to do. You do your share of the work."
>
> Focus Group B, Participant 19: "You never put work on other people like I can't do that now when you say you've already done it. And so an example (…) is we on our team each of us pulled through on our parts."

Focus group C offered example of how they contributed specifically on their presentation project, however, there was evidence that the work was not initiated by the

participants nor entirely completed by the participants. In fact the participants lacked ownership of their efforts as demonstrated in the following dialogue:

Interviewer: “What did you have to do to help your team be successful?”

Participant 21: “The presentation.”

Interviewer: “What about the presentation? What specifically did you do?”

Participant 21: “Basically the slides pretty much.”

Interviewer: “You put together the slides? Are you the only one that did the presentation?”

Participant 21: “Not really. Mostly. Um my mom helped me a little.”

Interviewer: “On your team, who helped? Did you help with it?”

Participant 22: “Yea. Me and my mom made a map of our state.”

Interviewer: “Ok. And you said (name) made?”

Participant 23: “A map of the Snake River.”

Interviewer: “Ok. Yes.”

Participant 24: “Me and my dad got some information and so did (name).”

Interviewer: “Excellent. Ok. Did you contribute to your project team?”

Participant 25: “I did. I helped with the presentation.”

Through this discussion there lacked a feeling of ownership with this project. It was difficult to get the participants to expand on what they learned and how their presentation went. Focus Groups B and D seemed excited about their presentation, what they learned, and how they presented the project, Focus Group C seemed to lack enthusiasm and appeared to project a sense that this was a project that was not theirs.

They seemed to consider the project was something they helped in making rather than having their coaches and mentors assist them in their project.

Self-Responsibility: This life skill is defined as taking care of oneself; being accountable for one's behavior and obligations; choosing for oneself between right and wrong. The life skill indicators for this life skill includes: 1) Do what is right for myself when with a group; and 2) Admit to mistakes I make.

Participants provided examples of their understandings about what it is to be committed to team. They also supplied evidence of how they follow through in their obligations and responsibilities for their team:

> Focus Group B, Participant 25: "Well like if you make a promise to do something you don't like say I'll do it later or you do it right then. If you say I'm gonna go home and um come up with a new plan and you don't do it and you need to be committed to your promise.

> Focus Group C, Participant 33: "Even if you something you want to do and you're committed to doing something you need to do that before you do the thing you want to do."

> Focus Group D, Participant 51: "I think commitment to your team is like not going to, like go skiing when you're supposed to be helping the team work something out."

Admitting to ones mistakes is another component in the life skill "Self-Responsibility" that the participants seemed to understand and could express not only the difficulty in admitting mistakes but also the purpose and importance of doing so:

> Focus Group B, Participant 24: "You don't act cocky and you don't get…I wish I hadn't done that. I'm sorry. You don't let it get to you but in order for the other teams convenience and for the rest of your teams convenience in order to get stuff moving you need to let them know what you did wrong. And so you just give it flat out."

> Focus Group D, Participant 49: "Admitting means telling people that you messed up or something like that and you didn't want to tell anybody but you did anyways."

During the interview with Focus Group D I accidently went off script and missed the questions pertaining to "Admitting mistakes I make." However, this group had a clear understanding that their obligation to support the team and be committed to their team included the determination to not give up when they became frustrated as illustrated in the following dialogue:

> Interviewer: "What does commitment mean to you? What does it mean to be committed to something?"
>
> Participant 30: "It means you don't give up and you keep trying to do it."
>
> Interviewer: "Very good. What does it mean to you?"
>
> Participant 31: "It means that even if there's many hard things to do you keep to that goal."
>
> Interviewer: "Ok. Very nice. Ok what does commitment mean to you?"
>
> Participant 32: "You don't quit."

Critical Thinking Skills. This life skill requires recall and comprehension, analysis, comparison, inference, application, synthesis and evaluation. The life skill indicators for this life skill includes: 1) Try doing activities more than one way; 2) Use other things I know to solve problems; and 3) Think of new ideas after doing an activity.

FIRST LEGO® League is designed to engage participants in critical thinking in the robot game. Participants must program and design a robot that will accomplish various tasks on a game board with in a set time limit. Participant 29 from Focus Group B shared and example of when they had to do an activity in a different way:

> Focus Group B, Participant 29: "Yes there is more than one way to do something. Such as our robot went over and got these what do you call them uh speed bumps and the speed bumps everyone was thinking of going over them with treads or something and we've thought of a ramp so there's more that one way of doing it.

When I asked the participants what prior skills or knowledge they used to accomplish their tasks in FLL, some participants had difficulty identifying their prior knowledge when asked directly. In the interviews I had to provide examples of possible prior knowledge they would have used in their tasks. After I had given examples, they participants understood and could offer some examples as demonstrated in the following dialogue:

> Interviewer: "Is there any time you had to use other things you know to solve a problem which sounds like what you were saying. Did you use other things like from school or other knowledge you had before to solve the problem with your robot? Can you give me an example of things that you already knew that you used to solve the problem?"
>
> No Response.
>
> Interviewer: "Did you know degrees before LEGO® League or after?"
>
> Several responded: "Yea."
>
> Participant 60: "I knew it before."
>
> Interviewer: "So are degrees important in FIRST LEGO® League?"
>
> All respond: "Yea."
>
> Interviewer: "And so that's something you knew before you came right? Is there anything else that you knew before that you used?"
>
> Participant 61: "Uh, how to use computers?"
>
> Interviewer: "How to use the computer. Very good." (Participant raises hand) "Yes."
>
> Participant 62: "I knew how to measure inches."

> Interviewer: "How to measure inches. Did you have to learn how to write? Or read…in LEGO® League?"
>
> All respond with laughter and excitement: "Yea."
>
> Interviewer: "Did you have to learn, is that maybe something you already knew or that you brought…"
>
> Students enthusiastically respond together with laughter. One student said, "I already knew how to read!"

Later in the transcripts when I began asking participants about their "Positive Identity" participants began identifying more descriptive examples of their prior knowledge:

> Focus Group B, Participant 34: "I learned how to use the computer a lot better because we were doing a lot of research and a lot of programming in the car on the computers."
>
> Focus Group B, Participant 35: "I think I learned it was, I learned a lot about the programming (…) stuff which I can now take and some of that may apply to program the first robotics competition. Robots, the theory of trial and error and sensors and I, that will help how I got the, my new knowledge of the program, it will help me even in when I'm just using the next step for fun.

The very nature of the FLL robot game is learning through trial and error. Teams learn how to program and design their robots through the act of attempting the game tasks. The process required for accomplishing a task involves trying and idea, evaluating the result, and then trying a new idea. Focus Group C, Participant 40 shared how their team tried an idea and then discovered a new way of accomplishing their task:

> "Before we were um trying to get into the round circle with the robot, by going around the long way and then coming in but then we discovered a new way that we could just crash right through the beacons and get in it would still count."

Positive Identity Skills. The life skill "Positive Identity" involves valuing oneself, having pride in oneself, understanding one's abilities strengths and limitations;

having a realistic assessment of one's abilities. The life skill indicators for this life skill includes: 1) Enjoy using my skills; 2) Do things for myself or others; and 3) Decide what I want to do.

I asked participants to share skills that they have gained in FLL that they really enjoy using. Participants shared that the skills they enjoyed using most were programming, designing and constructing their robots. I also asked them about what skills they had learned or developed that they are now able to use that they didn't before FLL. Many of the responses were specific pertaining to the content knowledge they acquired due to their research project. Some examples include:

> Focus Group B, Participant 31: "During the project I learned a lot about well for our project self healing concrete and about how snow is like transferred to places."
>
> Focus Group B, Participant 33: "I learned a lot about trains and how many cars try to beat them across the tracts or maneuver between the arms."
>
> Focus Group D, Participant 68: "Like researching stuff. I learned that you can research a lot more stuff than you think you can."

One participant share that they learned the skill of persistence and patience: "…like to take more time and try and fix it instead of just giving up after it didn't work." While other participants shared the skills they learned through working with others as exemplified in this dialogue with Focus Group D:

> Interviewer: "What skills have you learned that you are now able to use that you didn't before LEGO® League. Do you have some of those you've learned? Or maybe got better?"
>
> Participants responded: "Yes."
>
> Participant 65: "Working with certain people."

> Interviewer: "(Participant's name) you were a leader. Is there something you got better at in the last eight weeks?"
>
> Participant 66: "Leading."
>
> Interviewer: "Leading. Ok."
>
> Participant 66: "And not being shy."

Finally I asked the participants if they have thought about what they would like to do for their future career because of their FLL experience. 57% of the combined focus groups responded and 80% of the responses included careers in the fields of Science, Technology, and/or Engineering, 15% of the responses included the fields of education and law enforcement, and 10% was interested in becoming an entrepreneur.

Frequency Counts

To further investigate what participant responses reveal about their acquired life skills, I conducted further content analysis using frequency counts of the incidences participants discuss for each life skill (Stemler, 2001). For the following discussion I will be using the term *Response Incidences* in place of the term *Frequency Counts*. Figure 2 reveals the highest response incidences in focus group interviews was *Positive Identity* with 36 response incidences. In comparison, the lowest response incidences were in the life skill *Self-Responsibility* with 21 response incidences.

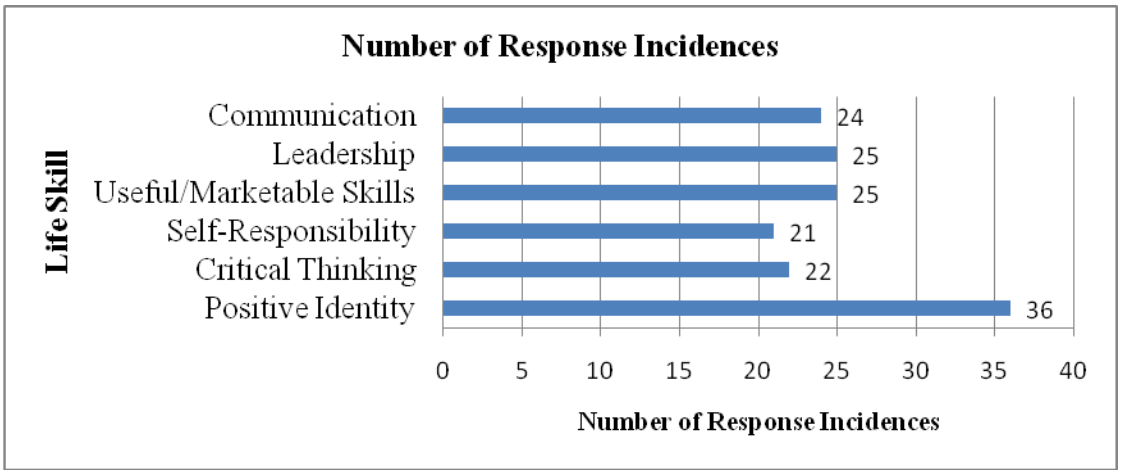

Figure 3. The focus group participant response incidences by life skill

The high incidences of responses for the life skill *Positive Identity* and comparatively lower response incidences were not what I expected based on the results from the LSET data. Therefore, I continued more detailed analysis by identifying the number of response incidences for each life skill indicator. The resultant graph displays the focus group participant's responses which reflect number of incidences in which the indicators were mentioned (Figure 3).

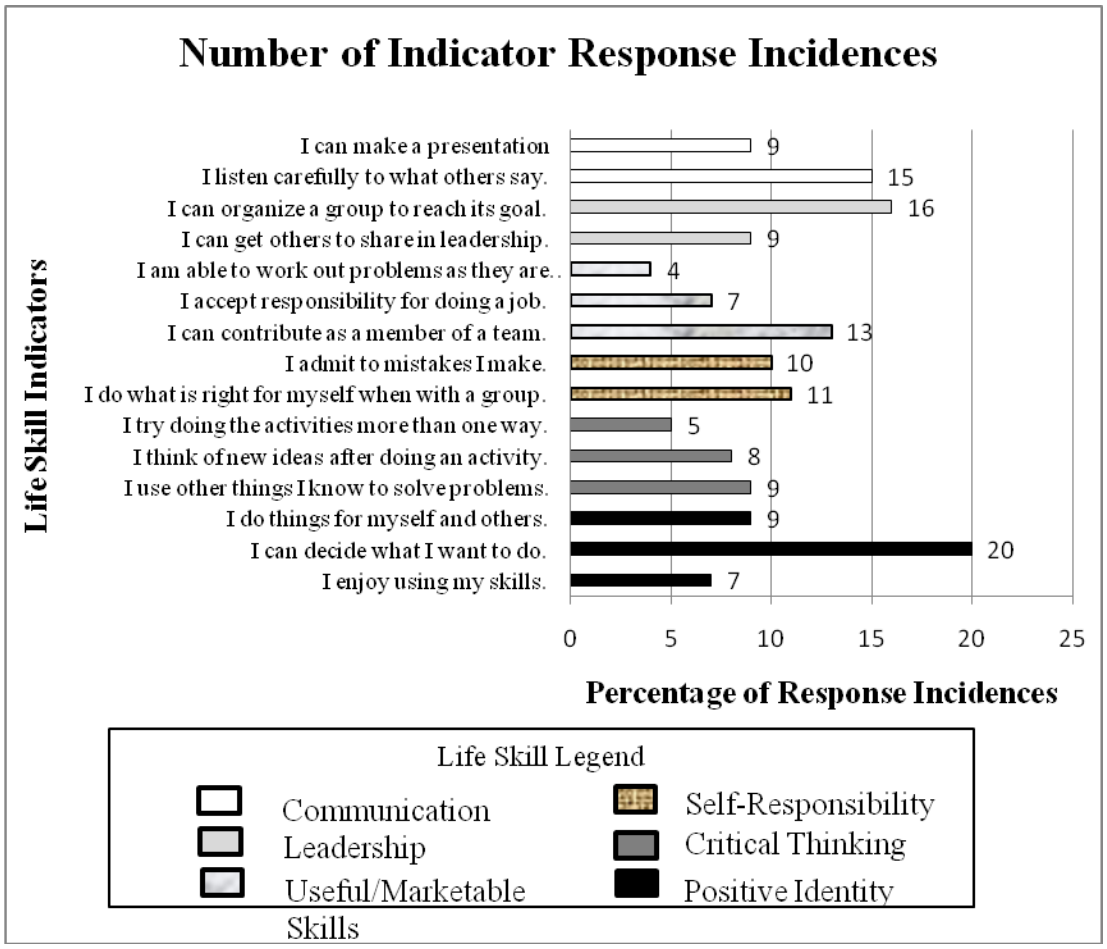

Figure 4. The focus group participant response incidences by indicator.

Life skill indicators mentioned with the highest counts was "I can decide what I want to do" with 20 response incidences. The lowest response incidences occurred with the indicator "I am able to work out problems as they are presented to me" with only 4 response incidences. These indicators response incidences contribute significantly to the overall scores for the life skills *Positive Identity* and *Self-Responsibility* and will be further addressed in the discussion.

Frequency Counts by Focus Group. I next wanted to compare response incidences of each focus group in each life skill. I began by sorting the data according to each focus group and calculated the percentage of response incidences for each life skill indicator. Then to create a standardized measure from which to compare each focus group, I averaged the response incidences of the indicators for each life skill. The resultant values provided a means from which to compare each focus group's response incidences for the six life skills (Figure 3).

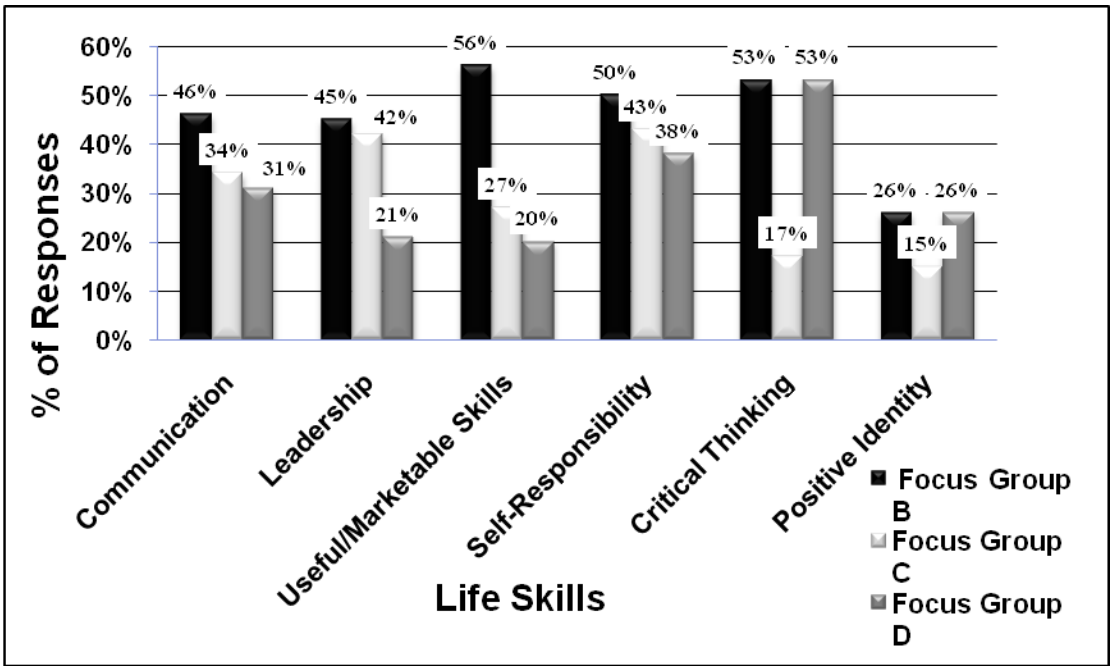

Figure 5. The percentage of response incidences of life skills for each focus group.

The data reveals Focus Group B to have the highest responses incidences in four out of the six life skills (26%-56%) with two of the life skills equaling that of Focus

Group D. Focus Group C had the lowest responses incidences in the life skills “Critical Thinking” (17%) and “Positive Identity” (15%). Whereas Focus group D had the lowest response incidences in four of the six life skills including: “Communication” (31%), “Leadership” (21%), “Useful/Marketable Skills” (20%), and “Self-Responsibility” (38%).

Quantitative and Qualitative

I compared the percentage of gain from the pre/post test instrument data with the percentage frequency of indicator responses to identify any further trends that emerged from the combined data. According to the quatitative measurement of percantage gain using the LSET, partipants perceived that they had grew in all life skills. When analyzing the participant responses from focus group interviews, the data strongly reveals evidence of life skill development. Participants were able to verbally describe ways in which they learned life skills in FLL. Examples of responses indicating life skill acquisition for each life skill indicator can be viewed in the following table:

Table 4

Example Participant Responses Indicating Life Skill Acquisition

Life Skills	Indicators (Codes)	Participant Response Examples
Communication	Make a presentation.	"We pretended that a light bulb blew up the flag and we passed out some matches to the judges." (Group D, 9 year old female)
	Listen carefully to what others say	"You um just do one of the person's ideas and then if it really not the answer then do somebody else's idea." (Focus group B, 12 year old female)
Leadership	Organize a group to reach its goal.	"While each person had a job, each person did their job so at the end it would all come together and get what we found out our thing was." (Focus group C, 10 year old male)
	Get others to share in leadership.	"Leadership like um, ok like one person could be like the head of the project, one person the head of programming and somebody else the head of designs and you share roles." (Focus group B, 11 year old male)
Useful/Marketable Skills	Work out problems that are presented to me.	"Um like if you if like one person doesn't know how to do something but you do you um say I can do that and so you do that as a job so." (Focus group D, 9 year old female)
	Contribute as a member of a team.	"It means that if the rest of the team has no ideas and you if you're not doing good you can still give an idea and maybe it will work. You can work well with the others too." (Focus group B, 11 year old male)
	Accept responsibility for doing a job.	"You stick in your two cents. You do what you know you need to do. You do your share of the work." (Focus group B, 13 year old male)

(table continues)

Table 4 (continued)

Life Skills	Indicators (Codes)	Participant Response Examples
Self-Responsibility	Do what is right for me when with a group.	"Well like if you make a promise to do something you don't like say I'll do it later or you do it right then. If you say I'm gonna go home and um come up with a new plan and you don't do it and you need to be committed to your promise." (Focus group B, 12 year old female)
	Admit to mistakes I make.	"I'm sorry but I messed up on this." (Focus group D, 10 year old male)
Critical Thinking	Try doing activities more than one way.	"Yes there is more than one way to do something. Such as our robot went over and got these what do you call them uh speed bumps and the speed bumps everyone was thinking of going over them with treads or something and we've thought of a ramp so there's more that one way of doing it." (Focus group B, 11 year old male)
	Use other things I know to solve problems.	"Well, sometimes we wouldn't get it right for the rotations or the degrees turn on our robot so we be like um, "How about we try these rotations or let's say by this many degrees." (Focus group D, 10 year old female)
	Think of new ideas after doing an activity.	"Before we were um trying to get into the round circle with the robot, by going around the long way and then coming in but then we discovered a new way that we could just crash right through the beacons and get in it would still count." (Focus group C, 10 year old male)

(table continues)

Table 4 (continued)

Life Skills	Indicators (Codes)	Participant Response Examples
Positive Identity	Enjoy using my skills.	"I really enjoyed programming the robots." (Focus group C, 10 year old male)
	Do things for myself or others.	"Um like after we did the LEGO thing for a while I got LEGOs for Christmas and I showed my friend how to use them." (Focus group D, 9 year old female)
	Decide what I want to do.	"I want to be a dermatological oncologist and its it's yea. I'd like to find a cure for skin cancer. And after doing this it makes me wonder off to the side I might want to build a medical machine or medical robot." (Focus group B, 13 year old male)

Further evidence of participant verbal responses of life skill acquisition was apparent when analyzing focus group responses incidences. Participants were frequently able to communicate examples of there experiences in their gain of life skills. For example in the indicator "I can decide what I want to do," participants provided 20 incidences of this indicator in the focus group responses, where as in the instrument there was only a 10% gain in this indicator. The interview responses indicate partcipants may have developed more in this life skill indicator than as reflected in the quatitative data. For this particular indicator, participants responded on the instrument with solely the indicator as a prompt. However, in the interview, participants were asked specifically what they have decided they want to do. The interview provided participants the avenue to respond to a more concrete prompt and supported discussion. Therefore participants

were able to provide evidence of their thoughts and development in this particular life skill indicator.

In contrast, the indicator “I am able to work out problems as they are presented to me” had a 19% gain on the LSET but only had four incidence responses. This may be do to the participants ability indicate on the instrument that they perceived they grew in this area. However, when asked for specific examples of this indicator the participants may have had difficulty providing specific examples due to the abstract quality of the skill.

Further analysis does reveal disconfirming evidence of life skill growth due to FLL from Focus group responses. Participant responses indicate that some participants either did not gain a specific life skill due to the treatment of FLL or may have gained the life skill due to other means. The following participant responses provide the incidences of disconfirming evidence for the life skills *Useful/Marketable Skills, Critical Thinking, and Positive Identity.*

Table 5

Example of Participant Responses Indicating Disconfirming Evidence of Life Skill Acquisition

Life Skills	Indicators (Codes)	Participant Response Examples
Useful/Marketable Skills	Accept responsibility for doing a job.	"Sometimes the coach told you to do something you didn't want to do and you didn't want to listen to the coach. You wanted to do your own thing." (Focus Group B, 13 year old male) Sometimes "John" didn't listen." (Focus group D, 9 year old female) "John responds": "Hey! I was." (Group D, 10 year old male)
Critical Thinking	Think of new ideas after doing an activity.	"No. I learned that at home." (Focus group C, 11 year old male) "I knew it before." (Focus Group D, 9 year old female)
Positive Identity	Decide what I want to do.	"No. I don't know. I don't think about it all that much." (Focus group B, 11 year old male) "Nothing that has to do with learning from this." (Focus Group C, 11 year old male) "I'm not sure." (Focus Group D, 9 year old female)

CHAPTER 5: FINDINGS, DISCUSSION, LIMITATIONS, AND IMPLICATIONS

This chapter will consist of five sections. I will begin with the first section by summarizing the study on Life Skill acquisition of FLL participants ages 9-14. The second section will review the findings from the statistical analysis of quantitative and qualitative data. In the third section I provide conclusions based on the research questions and follow with a discussion on those conclusions. The fourth section, Implications, will include practical suggestions for addressing the issues that have been raised in this study with suggests for further research. In the final section, I will identify and address the limitations of the study and again provide additional suggestions for further research.

Summary of the Study

It is the aim of youth development programs such as FLL to measure their impact on youth using valid measurements of life skill development. Theoretical and empirical literature provides a foundation on the pre-adolescent and adolescent development and how it relates to life skill development (Benson et al., 2006; Rhodes, Grossman, & Resch 2000; Tierney, Grossman, & Resch, 1995) and the life skills as measured by the LSET in FLL. The purpose of my study was to measure six life skill outcomes of children ages 9-14 participating in the FLL Idaho State tournament. The research questions I used to guide my investigation were:

1) *Is there a change in participant's perceptions about their of life skills from the start of their participation in FIRST LEGO® League when compared to the completion of the program?*
2) *What do participant responses in a focus group exploring their life skill development reveal about their perceptions of the life skills they developed as part of their participation in the FIRST LEGO® League program?*

Findings

The reliability analysis the life skills outcome survey, $N = 114$, revealed a Cronbach's coefficient alpha analysis of .85 for both the pre and post tests. The data revealed a significant increase in the scores for pre-composite ($M = 2.93$, $S = .44$) and post composite ($M = 3.40$, $S = .03$) responses; $t\ (113) = 15.87$, $p < .01$. To illuminate the life skills with which the students experienced the most growth I examined the mean scores of the pre-test and post test and calculated the resultant percentage gain for each life skill indicator ranging from 9% to 32%. In the qualitative analysis, the data revealed anecdotal evidence of life skill development in each life skill indicator. All three focus groups were able to provide evidence of their growth in each life skill; however, based on incidence response values Focus Group B had the highest incidence response values (26% - 56%) than that of the Focus Groups C and D (15% - 53%). The findings also reveal disconfirming evidence from focus group responses in life skills *Useful/Marketable Skills, Critical Thinking, and Self Responsibility*. This indicates that some life skill development may be due to other factors and not to the treatment of FLL.

Discussion

Life Skills

FIRST LEGO® League states in its mission the promotion of the development of youth in four areas: 1) Leadership in science and technology; 2) building science, engineering, and technology skills; 3) inspire innovation; 4) foster self-confidence; 5) and promote communication skills (Kamen, 2009). I found that when examining the LSET results, participants had the greatest average percent gains in the life skills *Leadership* (25%), *Communication* (19%), and *Critical Thinking* (18%). Conversely, *Positive Identity* was shown to have the lowest gain at 10%. These scores would seem to validate the FLL program's focus on the purposes as described in their mission statement. However, the qualitative data from focus group interviews reveal particularly high response incidences in the life skill *Positive Identity*. In the following discussion I will provide my thoughts as to what the data suggests about FLL and its consequent affect on youth life skill development.

Critical Thinking. On the LSET in the life skill *Critical Thinking* the indicator "I try doing the activities more than one way" had the third highest percent gain at 21%. However, there were only 5 response incidences for this indicator during focus group interviews. This indicator had the second lowest score as compared to all the other indicators. However, the focus group data showed the other two indicators for *Critical Thinking* had a response incidence of 8 for "I think of new ideas after doing and activity") and 9 for "I use other things I know to solve problems"). My data indicates participants experienced growth in their critical thinking as they participated in FLL. Interpreted in

context, it appears that FLL achieved the goal of fostering the participants' development of the critical thinking life skill. The FLL program provides ample opportunity for participants to develop critical thinking skills as participants actively problem solve different ways they can program or design their robots to accomplish various missions.

Communication. On the LSET the life skill "Communication" indicator "I can make a presentation" scored a 23% gain with the second highest gain of all indicators. The data from focus group responses indicated that participants could provide examples of their experiences with the presentation portion of their research projects (9 response incidences). However, the focus group responses revealed that participants had perhaps developed more in the *Communication* indicator "I listen carefully to what other say" with the second highest response incidence of 15.

FLL participants contribute a significant portion of their efforts planning, researching, creating, and presenting a project that is related to the FLL's yearly theme, all of which involves substantial engagement in communication. Creating a presentation as a group involves listening to teammates, creating and organizing information as a group, discussing and sharing research, deciding on what is significant to report and what is not. There is much practice and coordination involved with presenting the information as well. Ultimately due to the presentation project and other aspects FLL provides, both the LSET and focus group data indicate this program provides the means for participants to interact in ways that develop their communication skills.

Positive Identity. The results from the LSET reveal the life skill *Positive Identity* to be the lowest life skill gain amongst the other indicators with an average percent gain

of 10%. When analyzing the pre-test scores of indicators for this life skill participants had scored themselves high on the pre-test (see Table 1). Participants indicated that they felt they had a higher sense of *Positive Identity* prior to the treatment as compared to the other indicators. Therefore, there was a resultant lower percentage gain for that life skill from pre-test to post test due to the Likert design of the tool.

When examining the focus group data for the life skill *Positive Identity*, participant response incidences where low in the indicators "I do things for myself and others" (9) and "I enjoy using my skills" (7). This evidence supports the lower percentage in life skill gain on the LSET regardless of the higher pre-test responses. Further evidence from focus group data supports the quantitative data on this life skill. When participants were interviewed during the focus groups they indicated they had thought about what they would like to do in the future with a 20 incidence responses (see Figure 4). This statistic suggests that participants have an idea of what they would like to do in their future. It is possible that participation in FLL has an effect on participant ideas of their future careers. When further examining the responses on this indicator, of the 20 responses, 16 participants indicated they were interested in a specific career in the fields of science, technology, and engineering with the four remaining interested in public service or business. Therefore, even though there was a low gain in the life skill "Positive Identity" the life skill appeared to be an area that participants had considered. It is possible that participants already knew what they foresaw as their future careers explaining their higher pre-test scores and high incidences of responses.

Useful/Marketable Skills. Conversely, the *Useful/Marketable Skills* life skill indicator "I am able to work out problems as they are presented to me" had a relatively high percentage gain of 19% on the LSET but in the focus group interviews had a 4 response incidences. This may indicate participants felt they had growth due to the treatment. However, they may have had difficulty communicating how they worked out problems presented to them. In the focus group interviews, participants could identify the myriad of problems that were presented to them but they had particular difficulty explaining how they went about solving the problem. The participant responses during interviews indicated they were following directions from a group participant or a coach rather than problem solving on their own or as a group. There could be two possible reasons for this. First this could be an indication that the interview questions need to be edited in such a way to more efficiently address strategies the youth are using to work out their problems. Secondly, it may be due to the abstract quality of the skill, particularly with younger participants. Some of these participants are possibly operating in the concrete operational stage of cognitive development (Berk, 2005; Piaget, 1959) indicating they would have difficulty analyzing the results of their robot.

Focus Groups

A brief examination of the composition of the three focus groups would be most pertinent to discuss for this section. Focus Group B consisted of two teams with participant's representative of both genders and ages ranging from 10 to 14. Focus Group C consisted of one team of males ages 9 to 10. Finally, Focus Group D was an

enthusiastic group of both genders ages 9 to 11. I feel it necessary to bear in mind the composition of these groups throughout the following discussion as it may be telling of reasons for the resultant findings of this study.

Focus group B. This group was consistently higher in their response incidences as compared to the other two focus groups. I suspect this is due to their higher age range and would be consistent with developmental theories about youth development. Focus Group B was able to elaborate about their experiences during the interview. I rarely had to use additional questions to prompt the participants during the interviews. The quality of their shared experiences and examples of life skill development suggest they had more experience to draw upon due to their age, maturity, and experience in FLL. The qualitative data supports this posit when analyzing the focus group response incidences for the life skill *Useful/Marketable Skills*. Under this life skill students responded to questions about how they work out problems as they are presented to them, accepting responsibility for doing a job, and contributing as a team member. Focus Groups C and D provided limited examples about their experiences in this life skill or very short answers usually involving what adults directed them to do rather than explaining the process involved with using this life skill. Focus group B provided descriptive examples involving cooperation, putting the team's needs before your own, and using effective communication to accomplish this life skill.

Focus Group C**.** When examining the three focus groups, Focus Group C had characteristics that were notably different than the other two focus groups. During the focus group interviews, Focus Group C repeatedly had difficulty offering ideas and

examples in how they grew in most of the life skill areas. What I observed to be different about this group was that, as stated by Focus Group C participants, they had their roles with in their teams dictated by their coaches. This may be an indication of over influence by the adult coach, thereby constraining the development of communication and problem solving. In contrast, Focus Groups B and D had what seemed to be less intervention by adults. It was apparent that the participants in focus groups B and D decided on their roles based on team discussions, voting, and discovery of the strengths of their team mates and assigning their roles accordingly. Focus Group C functioned without much disagreement or discussion due to adult direction, which may contribute to their lack of response incidences in life skills *Positive Identity* (15%) and *Critical Thinking* (17%).

My experience in education has revealed to me the importance of students having opportunities to practice solving disagreements with direction from adults when necessary. When adults dictate student's roles and facilitate those roles without students learning how to navigate the issues power and disagreements, students fail to learn how to handle interpersonal challenges in a productive and positive manner.

Participants in Focus Group C also showed a lack of ownership to their research presentation. When I asked them about their project they often responded that they helped their coach or parent with the project. Whereas responses from focus groups B and D suggested a sense of pride with their projects. Responses from Focus Groups B and D also indicated they had gained a specific new understanding about the subject matter of their research project. Focus Group C again seemed to have more adult direction and

involvement than the other focus groups hindering their opportunity to develop and have ownership of their skills and abilities in relation to their research project.

FIRST LEGO® League is a program that facilitates the development of life skills in youth and, most effectively, the life skills of *Communication, Leadership and Critical Thinking*. Based on the findings and above discussion I strongly recommend that FLL is not appropriate for 9 year old youth as working with older participants limit their ability to most effectively acquire life skills and FLL values. In addition I recommend FLL programmers find ways to educate the supporting adults to limit their over involvement which may constrain the developmental life skills acquired by youth. Educating adults in the use of techniques such as inquiry based strategies is likely to enhance their ability to facilitate participant life skill development. My research indicated that there is a need to strike a balance between grouping participants by development level and preparing the adults that work with these participants to act as guides. This is the key to achieving the youth programming goals of FLL.

Directions for Further Research

Evidence from focus group interviews suggested that it is not appropriate for nine year old participants to participate or compete on teams with participants ages 10 to 14. Further research would be necessary to evaluate the programming that most effectively meets the developmental needs of nine year old participants in the FLL program.

Another issue present in this study is the role of the adult (i.e., coach, parent, mentor, etc.). I would suggest providing coaches and mentors with training on inquiry

based learning practices. Research shows that "Inquiry Based Teaching/Learning" improves student attitude and achievement (Haury, 1993; Lawton, 1997; University of Northern Iowa, 1997), facilitates student understanding (Borasi, 1992) and mathematical discovery (AAAS, 1993; NCTM, 1991). Further research could be conducted on evaluating the degree in which adult involvement and the effects of inquiry based instruction affects the life skill development of youth in programs like FLL.

There are four additional areas for further research. First, survey the FLL support adults (i.e., coaches, parents, mentors, etc.) to determine their perceptions of the youth participants' growth in life skill development, and then compare the survey results with that of the participants' LSET results. Secondly, survey the FLL adults' perceptions of their roles in FLL and in supporting youth participants' life skill development.

A third study could utilize a control group, such as a soccer program, and using the LSET for the youth participants in FLL and a control group to determine if there is a difference in participants' perceptions of life skill development. For a fourth study, it would be interesting to use the LSET as a pre-test, provide the treatment, and conclude with the LSET as a pre/post retrospective test. The purpose of the study would be to determine the difference in participants' perceptions of knowledge from the pre-test to that of the pre/post test following the treatment of FLL. Participants' perceptions of their life skill knowledge before the treatment compared to their understanding after the treatment may provide some insight about youths' understandings of their self-efficacy. The way in which FLL participants perceive their own abilities would further reveal participants' development of the life skill *Positive Identity*.

Limitations

I shall begin addressing the limitations of this study by recognizing my personal limitations as a coach of FLL and an elementary educator. I acknowledge the possibility that bias may have occurred due to my inclination to seek and foster life skill development in youth. However, as a researcher I strove to be an objective observer and to remain open to the possibility of a null hypothesis.

The life skill evaluation tool was sent out to state qualifying teams to fill out as part of their registration form requirements via email. The forms were then collected at the registration table during team registration at the state tournament event. This reveals two areas that were problematic. First, participants filled out the forms under the direction of a coach. It is unknown whether the instructions on the instrument were read and the completion of the instrument was monitored. Secondly, a lower number of life skill evaluation tools were completed and returned than expected. Due to time, money, and scheduling constraints further evaluation tools were not taken by teams and completed on site. In further research or evaluation of programming, it should be scheduled as a part of the program's event for the LSET to be distributed and filled out by participants on site to ensure the highest possible return. A qualified individual should provide instructions for filling out the tool and monitor the completion of the tool for most accurate results.

The LSET is a retrospective instrument that requires a certain level of readability for participants to complete the survey. However, through the validation process of this

instrument the vocabulary and reliability of the instrument has been tested and validated for use to measure life skill development on youth ages 9 to 14.

There is a limitation due to the convenience sampling of focus group participants. However, the focus groups are representative of typical teams competing in FLL. In future research I recommend conducting a random sampling of participants. This can be done by acquiring the contact information of teams participating in the state tournament and randomly selecting teams to invite to focus group interview sessions.

Due to methods utilized to preserve participant anonymity it is unclear how many in each age category spoke during focus group interviews. Coding more closely the individual speaking rather than just recording the age of the speaking participant would enable further analysis of the responses in the focus group interviews by age.

All data collected was self-reported leaving constraints on the possibility of independently verifying the data. It was then necessary to take what the participants said during the focus group interviews and how they responded on the life skill evaluation tool at face value. Therefore the life skill evaluation tool and focus group participant responses hold four possible sources of bias: (1) Selective memory; (2) telescoping; (3) attribution; and (4) exaggeration.

Since this study did not include a control group, it is unclear if a life skill can be attributed to the FLL activities, maturation, or from an auxiliary source of influence on participant development. However, the qualitative data do show evidence of participants using life skills directly and incorporating the language of the values of FLL.

Lastly, the very nature of action research poses environmental distractions affecting participants' verbal and emotional responses to interview questions. The FLL tournament posed numerous distractions to youth participating in the focus group interviews. However, participants and the adults representing them were excited about being in the focus group interviews and expressed appreciation for the opportunity.

Summary

FLL provides the necessary design through team work, problem solving, and the marriage of science, engineering and technology to promote life skill development in youth ages 9 to14. The program most effectively targets the life skills *Communication*, *Leadership*, and *Critical Thinking*. However, based on the findings from this study and the theory of youth development, special consideration should be noted when determining the proper age categories competing together in FLL. Overall, this study provides evidence to suggest FIRST LEGO® League is a program that provides an avenue for participants to develop life skills that will prepare them for the 21st Century.

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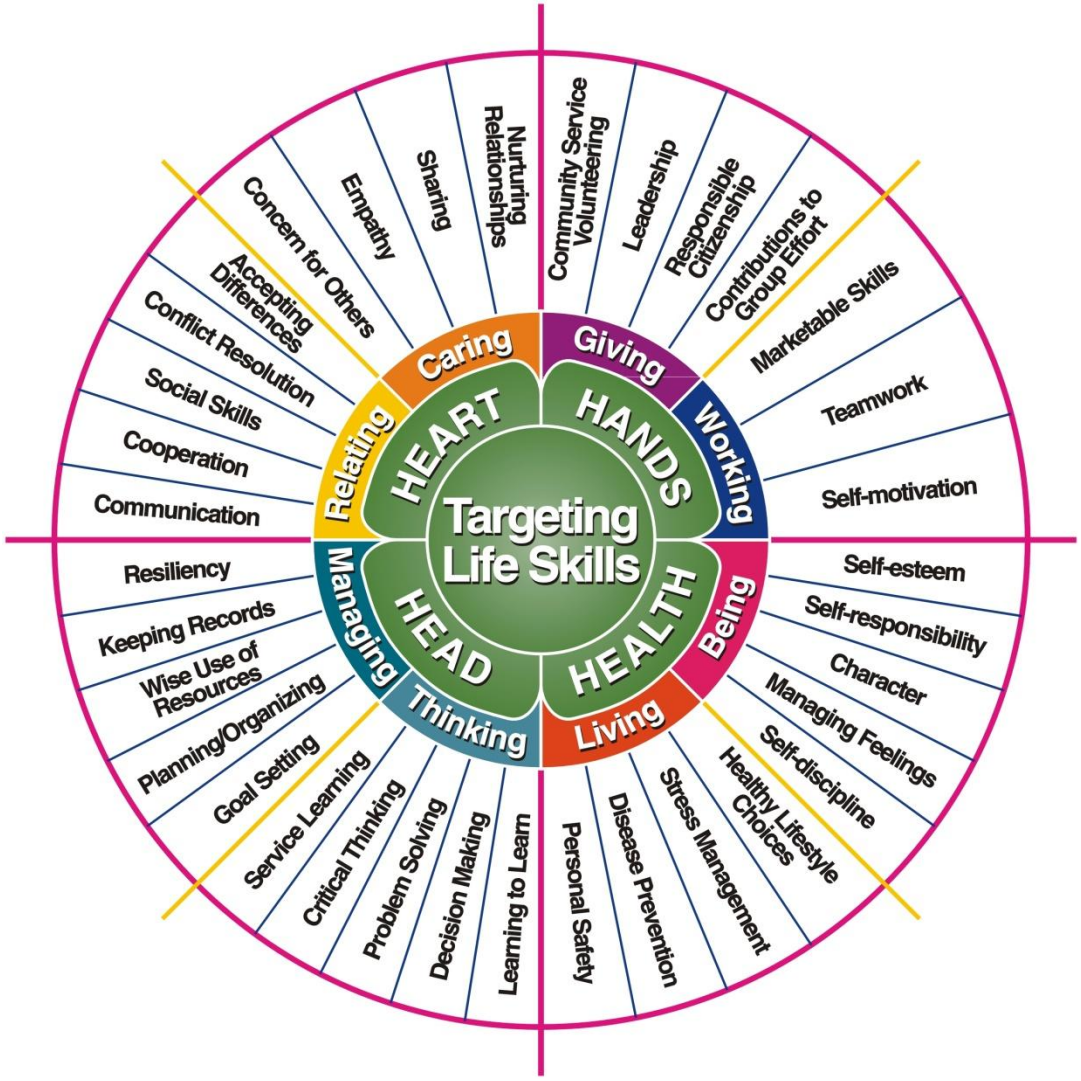
APPENDIX A

Targeting Life Skills Model

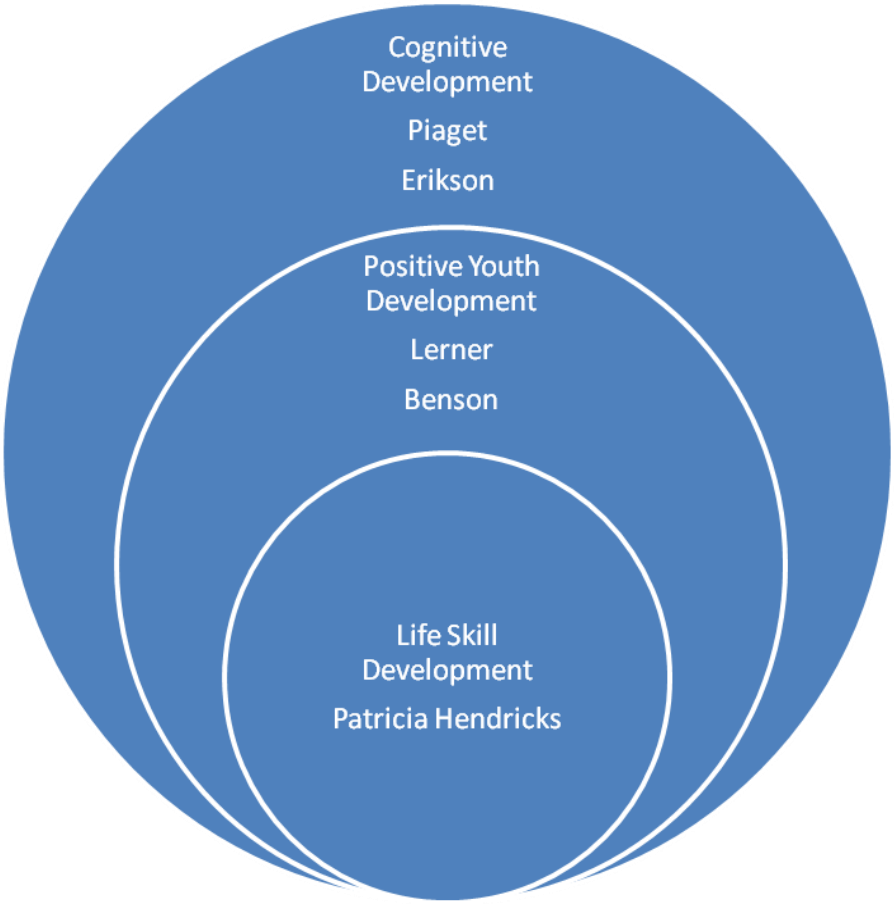
Targeting Life Skills Model



APPENDIX B

Theoretical Framework

Theoretical Framework



APPENDIX C

Definitions for Terms and the Interrelationship of FLL Objectives and the Life Skill Constructs

Measured Life Skills[i] Defined	Life Skill Indicators[ii] Measured	FIRST Mission[iii] and Values[iv]
Communication: The exchange of thoughts, information, or messages between individuals using speech, writing, gestures, and artistic expression.	1. Make a presentation. 2. Listen carefully to what others say.	**Mission:** "To inspire young people to be science and technology leaders, by engaging them in exciting mentor-based programs that build science, engineering and technology skills, that inspire innovation, and that foster well-rounded life capabilities including self-confidence, communication, and leadership." **Values:** **Gracious Professionalism™:** The "way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community. It is part of pursuing a meaningful life. One can add to society and enjoy the satisfaction of knowing one has acted with integrity and sensitivity." **Coopertition™:** The act of "displaying unqualified kindness and respect in the face of fierce competition. Coopertition is founded on the concept and philosophy that teams can and should help cooperate with each other even as they compete. Coopertition involves learning from and teaching teammates. It is learning from mentors, and managing and being managed. Coopertition means competing always, but assisting and enabling others when you can."
Leadership: To assist a group in meeting its goals by showing or directing along the way; using personal influence to guide a group in reaching its goal.	1. Organize a group to reach its goal. 2. Get others to share in leadership.	
Useful/Marketable Skills: To have the abilities wanted by employers and needed to hold a job.	1. Work out problems that are presented to me. 3. Contribute as a member of a team. 4. Accept responsibility for doing a job.	
Self-Responsibility: Taking care of oneself; being accountable for one's behavior and obligations; choosing for oneself between right and wrong.	1. Do what is right for myself when with a group. 2. Admit to mistakes I make.	
Critical Thinking: Requires recall and comprehension, analysis, comparison, inference. Application, synthesis and evaluation.	1. Try doing activities more than one way. 3. Use other things I know to solve problems. 5. Think of new ideas after doing an activity.	
Positive Identity: Valuing oneself, pride in oneself, understanding one's abilities strengths and limitations; realistic assessment.	2. Enjoy using my skills. 3. Do things for myself or others. 5. Decide what I want to do.	

APPENDIX D

First Lego® League Life Skills Survey

Please complete one form per child. **Team Number: _____**

FIRST LEGO® League Life Skills Survey

We want to know how well the FIRST LEGO® League program works. Participant input on this survey will help us improve the program. Please fill out this questionnaire to help us know what you have learned because of your experience with FIRST LEGO® League! Thank you!

Parent/Guardian: Please help your child complete this survey. And, please not the format for the questions. Each of the 15 questions requires 2 responses, a Before AND an After (NOW) participation. In other words, participation in FLL helped or did not help development and to what degree.

Tell us about yourself. *(Check one response to each question).*

1. I am _____ years old.

2. I am a: ___*Girl* ___*Boy*

3. I would describe myself as:

___ *African American* ___ *Hispanic*
___ *American Indian* ___ *White/Caucasian*
___ *Asian American* ___ *Racially mixed*

3. My current home is a:

___*farm*
___*rural, non-farm*
___*town under 50,000*
___*city over 50,000*

4. I Live in: _____ County

Read the following statements and check the box that best describes your ability both before and now (after) being in FLL.	***Back . . . before I participated in the FLL.***				***Now . . . after I have participated in the FLL.***			
	Never	***Sometimes***	***Usually***	***Always***	***Never***	***Sometimes***	***Usually***	***Always***
1. I can make a presentation.	☹	😐	☺	✪	☹	😐	☺	✪
2. I listen carefully to what others say.	☹	😐	☺	✪	☹	😐	☺	✪
3. I can organize a group to reach its goal.	☹	😐	☺	✪	☹	😐	☺	✪
4. I can get others to share in leadership.	☹	😐	☺	✪	☹	😐	☺	✪
5. I am able to work out problems as they are presented to me.	☹	😐	☺	✪	☹	😐	☺	✪
6. I can contribute as a member of a team.	☹	😐	☺	✪	☹	😐	☺	✪
7. I accept responsibility for doing a job.	☹	😐	☺	✪	☹	😐	☺	✪
8. I do what is right for myself when with a group.	☹	😐	☺	✪	☹	😐	☺	✪
9. I admit to mistakes I make.	☹	😐	☺	✪	☹	😐	☺	✪
10. I try doing the activities more than one way.	☹	😐	☺	✪	☹	😐	☺	✪
11. I use other things I know to solve problems.	☹	😐	☺	✪	☹	😐	☺	✪
12. I think of new ideas after doing an activity.	☹	😐	☺	✪	☹	😐	☺	✪
13. I enjoy using my skills.	☹	😐	☺	✪	☹	😐	☺	✪
14. Do things for myself or others.	☹	😐	☺	✪	☹	😐	☺	✪
15. I can decide what I want to do.	☹	😐	☺	✪	☹	😐	☺	✪

This questionnaire should take less than 10 minutes of your time to complete. You do not have to fill out this out and if you decide not to fill out this questionnaire, it will not affect your participation in future FIRST LEGO® League programs. Your answers will be anonymous and will not be identified in any way. This means that no one will know how you have answered any of the questions. Answering the questions means you agree to participate in this questionnaire. If you have any questions about this questionnaire or the evaluation, you can contact Kristina Luckey, kristina.luckey@boiseschools.org or Dr. Tim Ewers, tewers@uidaho.edu.

APPENDIX E

Parent Consent / Youth Assent for 4-H Life Skill Evaluation

Please complete one form per Child

Parent Consent / Youth Assent for 4-H Life Skill Evaluation

As a participant in the FIRST LEGO® League program your son or daughter may be asked to help with the evaluation of the program. At the end of each program or program year, we conduct an evaluation to tell us how well the program is working. Your son or daughter may be asked to complete a written survey about what he or she may have learned from participating in the program. The data may be used in other program evaluation research.

We estimate that it will take the youth participants approximately 10 minutes to complete the survey. Kristina Luckey, a doctoral student from Boise State University, will be using the survey responses for a study on how well FIRST LEGO® League cultivates participant life skills development. Upon you and your child's permission, she is conducting a 45 minute audio recorded focus group that will help in determining life skill outcomes due to participating in the FIRST LEGO® League program. **This study and evaluation will benefit your child and other children by providing information to further improve and help in acquiring future funding for youth programs like the FIRST LEGO® League**. There may be risks involved as children may choose to share private information with the interviewer. Kristina Luckey will treat all information with confidentiality and if needed will follow the appropriate protocol as determined by state and federal laws. The focus group protocol and script is available for parental view upon request.

Youths are not required to participate in the evaluation and/or focus group. If your son or daughter decides that he or she does not wish to participate, it will not affect his or her participation in this or future FIRST LEGO® League programs. If your son or daughter does not want to answer some questions on the survey and/or focus group, that is okay. The survey and/or interview responses will be anonymous, and your son's or daughter's responses will not be identified in any way.

Please read and explain the paragraphs above to your son and daughter. If they have any questions contact Kristina Luckey. If you do not want your son or daughter to participate in the evaluation and study of FIRST LEGO® League program, please contact Kristina Luckey at 208-514-0629. If you have any questions about the evaluation form, you can contact Dr. Tim Ewers, tewers@uidaho.edu or Maureen Toomey, mtoomey@uidaho.edu, Idaho 4-H Youth Development. All surveys may be reviewed at www.4h.uidaho.edu

* *

Please circle the bold faced word that applies and provide your signature:
My child **may / may not** participate in the evaluation of this program with the understanding that at any time they may withdraw from the evaluation without affecting his/her participation in the FIRST LEGO® League program.

_____ _____
Parent signature Date

My child **may / may not** participate in a focus group with Mrs. Luckey and other FLL participants to find out more about the life skills they learned due to their participation in FIRST LEGO® League. I give permission to Mrs. Luckey to audio record my child as she asks them questions about their participation in First LEGO® League. I understand that my child may discontinue the interview at anytime.

_____ _____
Parent signature Date

I **will / will not** fill out an evaluation survey and may stop filling out the survey at any time during the FIRST LEGO® League program.

_____ _____
Youth signature Date

I **will / will not** participate in the focus group conducted by Mrs. Luckey about the life skills I have learned by participating in FIRST LEGO® League and I know that I may discontinue my participation in the focus group at anytime.

_____ _____
Youth signature Date

The 4-H Life Skill Evaluation was approved for use by University of Idaho Human Assurance Committee on March, 2008, HAC #: 07-195 Toomey. The 4-H Life Skill Evaluation study was approved by the Boise State University Institutional Review Board: May 28th, 2009, BSU #108-09-096. Research at Boise State is conducted under the oversight of the BSU Institutional Review Board. Questions or concerns about research participants' rights may be directed to the BSU IRB office, Boise State University, Division of Research Office, 1910 University Drive, Albertsons Library Rm. 153, Boise, Idaho 83725-1135, Telephone: (208)426-5732.

APPENDIX F

Letter Sent to All State Qualifying Teams

From Idaho State FLL Tournament Director, Timothy Ewers

Sent out January 8, 2010 by the Idaho State FLL Tournament director, Timothy Ewers, to all state qualifying teams:

1. Attached you will find the Idaho State FLL Championship Tournament Handbook. In this handbook there is some very important information including a general schedule (subject to change - you will get an official schedule upon check-in), what to do before the tournament, what to do before you arrive, the day of the tournament information, safety, what to bring to the tournament, reminders, physical building addresses for events, Idaho State University map, FLL Team Information Sheet, Consent Forms, and Life Skills Survey.

***Please Note: Even though you filled out a consent form for the qualifier, a consent form needs to be filled out for every child and coach. These need to be given to the registration desk upon check-in.

***Another Note: Please have each child fill out a FIRST LEGO® League Life Skills Survey. These need to be turned in to the registration desk upon check-in.

Please put your team number on everything you turn in.

Included in the Idaho State FLL Championship Tournament Handbook were the following instructions for the survey:

On page 5 of the handbook as part of the list of "What to Do Before the Tournament":

- Complete the Parent Consent/Youth Assent for 4-H Life Skill Evaluation Form. One per child participant. This form goes to a program evaluator. See attached form and please make copies for each child.

- Complete the FIRST LEGO® League Life Skills Survey (Optional but very helpful to our program. This form goes to a program evaluator. See attached form and please make copies for each child.

On page 10 of the handbook as par to the list of "What to Bring to the Tournament":

Forms (Please provide these forms at the registration table when you check in tournament day.)

- Three complete Team Profile forms (See attached form. Please make copies.) You will hold on to these forms to give to the judges during the judged sessions.
- Completed FIRST consent forms for each team member, coach and mentor (See attached form. Please make copies.)

- Completed the Parent Consent/Youth Assent for 4-H Life Skill Evaluation forms for each youth member (See attached form. Please make copies.)
- Completed FIRST LEGO® League Life Skills Survey for each youth member (See attached form. Please make copies.)

APPENDIX G

Focus Group Protocol/Script

Focus Group Facilitator:
"Hello everyone! Today we will be celebrating all that we learned during our LEGO® league season! I would like to ask you some questions to find out what you learned and to help us make next year even better! I will be audio taping what you say to review what you learned. Know that anything you say will be anonymous and that being part of this conversation is voluntary. Let us begin!"

Questions:
Communication:

1. Now that you have experienced working together as a team, what did you find was challenging about working with one another?
   a.) What were some of the benefits of working together?
2. What was your favorite part about making a presentation?
   a.) What were some challenges you had in making your research presentation and how did you solve them?
3. When you are listening to your coaches, mentors, and/or teammates, what are some ways to listen well?
4. When you are speaking to your coaches, mentors, and/or teammates, how do you communicate what you want to say?
5. What are the best ways that you have found work best in settling disagreements you have with one another?

Leadership:

1) How did you organize each other to accomplish your project or reach your goals?
   a) What does it mean to cooperate?
   b) Can you tell me about a time when you had to cooperate as a group?
2) What is Gracious Professionalism?
   a) Can you tell me of an example when you showed Gracious Professionalism?
   b) Do you show Gracious Professionalism to just your team or do you also show it to other teams?
   c) Can you give me n example of a time when you showed Gracious Professionalism to another team or saw a team display Gracious Professionalism?
3) Where there times when you had to share in the leadership of the team?
   a) Can you give me an example of a time when you had to share in your leadership?
      i) Was it difficult at times to cooperate with one another?
      ii) Did your coaches and mentor help you to work through those times when teammates are not cooperating?
      iii) How did they go about helping you?

Useful/Marketable Skills:

1. What does it mean to contribute as a team member?
   a.)What are some things you have to do to help your teammates?
   b.)How do you support your teammates when you can't be a part of the game?

2. We have given you many instructions that you have to follow throughout the season. What were some things that were difficult about following instructions?
    a)Have you discovered some new ways or strategies for following instructions?

Self-Responsibility:

1. If you make a mistake, is it easy to admit to the mistake?
    a.) What do you say to your teammates when you make mistakes?
    b.) What do you say to your teammates when they make mistakes?
    c.) Mistakes are sure to happen. What have you learned to be the most productive way of handling mistakes that are made?
2. What does a commitment mean to you?
    a.)How have you followed through on the commitments you have made this season? Is it difficult or easy?
    b.) If it was difficult explain how you overcame that challenge?

1. When you are deciding on how to change your robot's programming or change your research presentation, did you think out what might happen due to your decision?
    a.) If you didn't, what did happen?
    b.) What would you think through differently?
2. When you make a decision as a group or individually, did you think about whether or not that decision worked well for you or the group?
    a.) Did you get some input on your decision with a coach, mentor, or teammates?

Critical Thinking:

1. Is there more than one way of doing something? Give me an example.
2. Is there any time you had to use other things you know to solve problems?
3. Where there times when you came up with a new idea to solve a problem or to add to your presentation? Give me an example.

Positive Identity:

1. What skills have you learned/developed that you are now able to use that you didn't before the LEGO® league season?
2. Are there skills or things that you are able to do now for yourself that you really enjoy due to your experience in FLL?
3. What can you now do for others because of these skills you have learned in FLL?
    a.) Are there things that you can or have taught you teammates or others in FLL?
4. Because of your experience in FLL do you think about what you would like to do for your future career? Explain.

"Thank you everyone! It was a fantastic year and I can't wait for next season to start next year! We hope you will join us again for the fun!"

APPENDIX H

Apriori Codes

Apriori Codes

Life Skill	**Code**
Communication	**Purple**
Leadership	**Yellow**
Useful/Marketable Skills	**Blue**
Self-Responsibility	**Orange**
Critical Thinking	**Green**
Positive Identity	**Pink**

APPENDIX I

Focus Group Age/Gender Log

Focus Group Age/Gender Log

Indicate Male/Female

Position Spoken	9	10	11	12	13	14	Position Spoken
1							1
2							2
3							3
4							4
5							5
6							6
7							7
8							8
9							9
10							10
11							11
12							12
13							13
14							14
15							15
16							16
17							17
18							18
19							19
20							20
21							21
22							22
23							23
24							24

ENDNOTES

[i] As defined by the Washington State Cooperative Extension Life Skills Evaluation System (Bailey & Deen, 2002)

[ii] As listed by the Washington State Cooperative Extension Life Skills Evaluation System (Bailey & Deen, 2002)

[iii] http://www.usfirst.org/aboutus/content.aspx?id=34

[iv] Dr. Woodie Flowers, *FIRST* National Advisor and Pappalardo Professor Emeritus of Mechanical Engineering, Massachusetts Institute of Technology, coined the term "Gracious Professionalism™."