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Should Projects Be More Creative By Being On A Team?

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Should Our Project Solution Be More Creative Because We Are A Student Team? A Cross-Disciplinary Study of Creative Classroom Projects in a Project Based Learning Environment

Presenter: Dr. Lilia Gomez-Lanier
Assistant Professor, College of FACS
University of Georgia
Definition of Team: A number of persons associated together in work or activity, such as a group on one side (Webster-Merriam Online Dictionary, 2016)

Team size = Creativity?
Introduction

The changing demands of globalization, technologies and knowledge-based economies have forced businesses to adopt collaborative work environments composed of employees that are both, *creative and innovative* in order to maintain a *competitive business edge and success*. 
Introduction

- Higher education in response to the demands of the marketplace has widely adopted collaborative learning activities in the classroom, where they are often integrated with traditional lecture techniques (Johnson, Johnson and Stanne, 2000; Gubera and Aruguete, 2013)
Higher education - student teams collaborating
Google’s creative office environments - team and individual
Creativity and Life Skills

- Although higher education has historically placed an emphasis on students acquiring the necessary knowledge and skills sets of their respective discipline, research suggests that in creating multiple solutions to a problem the acts of creativity and students' life skills are enhanced (Mills and Treagust, 2003; Musa et al, 2012; Neo, 2005)

- Life skills as defined by Neo (2005) are the ability to:
  - Collaborate
  - Critical thinking
  - Communication
  - Presentation of ideas
  - Time management.
Research Study’s Purpose

- The present study aims to explore whether higher education students in project based learning environments are more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment.
  - Does a specific team size enhance creativity by encouraging students to generate a wider variety of ideas?
  - Of the various life skills, such as communication, time management, and critical thinking, which are enhanced more when students work in teams compared to working alone?
Creativity and Learning in Collaborative Environments

- **Project Based Learning:**
  - The PBL model is a student centered constructivist approach to learning that focuses on constructing knowledge by using concepts, tools, experiences and technologies within a social activity to answer questions and solve real world problems (Krajcik and Blumenfeld, 2006; Lee, Jean S., Blackwell, Sue; Drake, Jennifer; and Moran, Katryn A., 2014).
  - A question or a problem serves to organize and drive activities in order to develop a product that addresses a driving question based in real world needs and demands (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, and Palincsar, 1991).
  - As an important component of self directed learning PBL prepares students to adapt and motivate themselves to work their way to a solution using their own pace, sequence and prior experiences and knowledge (Wurdinger and Qureshi, 2014).
Creativity and Learning in Collaborative Environments

PROJECT BASED LEARNING

Publicly Presented Product
Driving Question or Challenge
Feedback & Revision
Need-to-Know
Student Voice & Choice
Inquiry & Innovation
21st Century Skills

PBL
Creativity and Learning in Collaborative Environments

- **Collaborative Learning:**

  Collaboration learning is an activity that involves two or more individuals who interact with each other to develop a process from which the team can work together to resolve a problem as part of a learning activities requirement (Alavi, Wheeler and Valacich, 1995; Patel, Pettitt, & Wilson, 2012).

- Knowledge is actively restructured, acquired and exchanged when team members openly discuss ideas and exchange research information amongst team members (Brindley, Walti and Blaschke, 2009).
Creativity and Learning in Collaborative Environments

- **Collaborative Learning:**
  - In terms of stimulating *creativity* within collaborating learning setting, literature suggests that the use of innovative, exciting and realistic tasks can stimulate creativity (Davies, Jindal-Snape, Collier, Digby, Hay, and Howe, 2012).
  - The *perceived support* of educators and *flexible self-directed learning* environment promotes greater open communication between student and team members and student and educators during collaborative activities (Beghetto, and Kaufman, 2007).
  - Although *social bonding* amongst team members contributes to the construction of knowledge, the level of knowledge and benefit are dependent upon each team member's contribution (Brindley, Walti and Blaschke, 2009).
Creativity and Learning in Collaborative Environments

- **Creativity:**
  - Literature indicates that although there is no one definition for creativity, most researchers agree that creativity is defined by two key characteristics (Guilford, 1950; Beghetto & Kaufman, 2007; Klausen, 2010).
  - 1st characteristic is that creativity must represent something new or different
  - 2nd second characteristic is appropriateness

- It is not enough to for an idea be a novelty; the idea should also be task appropriate or useful.
Creativity and Learning in Collaborative Environments

- **Creativity:**
- Amabile's (1983, 1996) research indicates that creative expression and the development of creative potential emerge from a mixture of both individual and social factors found in one's environment.

- Used across disciplines to understand creative problem solving. Amabile's (2013) theory known as “Componental Theory of Creativity” lists the four necessary components for any creative response:
  - 3 components are within the individual - creative thinking skills, task motivation and domain relevant skills, and
  - 1 component is outside of the individual - the social environment in which the individual is working.
Methodology

- The purpose of this mixed methods study was to explore whether higher education students in project based learning environments are more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment? Research questions posed were:
  
  - **RQ1** - Are higher education students in project based learning environments more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment?
    - **HO1** - Higher education students in project based learning environments are more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment.
  
  - **RQ2** - Does a specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone?
    - **HO2** - A specific team size enhances creativity by encouraging students to generate a wider variety of ideas compared to students working alone.
  
  - **RQ3** - Of the various life skills, such as communication, time management, and critical thinking, which are enhanced more when students work in teams compared to working alone?
    - **HO3** - Various life skills, such as communication, time management, and critical thinking, are enhanced when students work in teams compared to working alone.
Methodology

- **Theoretical Framework**

  Constructivist education theory guided the development and inquiry of this research study.

  Constructivist learning environments have shown to promote creativity through student collaboration and interactions.

  Constructivist learning environments, such as project teams, have shown to nurture students to engage, be motivated and cultivate learning capabilities while pursuing the solution to a problem.

  Constructivism learning cultivates students to be active participants in their own learning processes and by doing so promote higher levels of knowledge and skills. In summary, students learn how to think and understand the material in its various forms rather than rely on memorization (Neo and Neo, 2013).
Context and Participants

The research study was undertaken in the fall 2016 term at a large public higher education institution in the southeast section of the United States. The study included 20 student participants of which all were female and representing three academic levels with 12 senior students, seven junior students and one graduate student.

Students were from the five disciplines of interior design, fashion and merchandising, real estate, communications and lastly, human development.

In terms of the disciplines, there were nine interior design students, six fashion and merchandising students, three human development students, one real estate student and one communications student.

Although the real estate and communications students have their own respective majors, these three students were enrolled in the fashion and merchandising class when the research study occurred. Students from other academic disciplines are allowed to minor and enroll in the fashion and merchandising program.
Methodology

- **Context and Participants**
  - All of the participants were enrolled in a course that had at least one course assignment that was a team project that problem solved a common everyday issue in that respective discipline as well as problem based assignments for students to work on alone.
  - Class time was given to students to work on their respective projects.
  - The courses had both individual students and student teams' work on similar projects; however, the team projects were more complex in scope.
    - The human development class problem solved a family crisis.
    - The interior design class designed an interior design spaces for a client.
    - The fashion merchandising class solved retail merchandising product development issues.
Methodology

Data Collection and Analysis

This research study employed a mixed methods approach involving an online 28 questions survey developed by the author that asked students to rank their perceptions using a five-point Likert scale.

Of the questions the first two questions pertained to the demographic data of academic level and discipline, 24 questions dealt with the study’s purpose and the last two questions were open ended questions that brought insight into the students’ point of views on working on student teams compared to working alone.

Quantitative survey questions content:

Survey questions 1-9 provided data on whether students more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment.

Survey questions 10-18 provided data on whether a specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone.

Survey questions 19-24 provided data on life skills

Qualitative survey questions content:

List two items that you perceived to be better about working with student teams as opposed to working alone?

List two items that you perceived to be worse about working with student teams as opposed to working alone?

The same survey was completed at the beginning and end of a student team project based assignment.
Data analysis

RQ1: Are higher education students in project based learning environments more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment?

<table>
<thead>
<tr>
<th>Descriptive Statistics Pre-Study</th>
<th>Descriptive Statistics Post- Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>1. I am more likely to be motivated on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>2. I am more likely to have more creative ideas on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>3. I am more likely to explore ideas on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>4. I am more likely to be more successful on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>5. More likely to do research on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>1. I am more likely to be motivated on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>2. I am more likely to have more creative ideas on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>3. I am more likely to explore ideas on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>4. I am more likely to be more successful on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>5. More likely to do research on a team than working alone</td>
<td>20</td>
</tr>
</tbody>
</table>
RQ1- Are higher education students in project based learning environments more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment?

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</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td><strong>Minimum</strong></td>
</tr>
<tr>
<td>6. More likely to work at my own pace with a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>7. More likely to be creative on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>8. More likely to be comfortable to ask for help on a team than working alone</td>
<td>20</td>
</tr>
<tr>
<td>9. More likely to be productive on a team than working alone</td>
<td>20</td>
</tr>
</tbody>
</table>
Data analysis

RQ1- Are higher education students in project based learning environments more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment?

► Summary

► RELIABILITY - A Chronbach's Alpha reliability test was conducted for the pre-study questions that produced a value of .856, while the post study questions showed a .840 value which indicates that the construct is reliable for both cases.

► PRE-STUDY Mean - Of the 9 questions for the majority of the questions (1, 2, 4, 7, 8 and 9) students were neutral on whether being on a team or working alone leads students to being more motivated, being more creative ideas, more successful academically and being productive. For question 3 students lean toward agreeing that they are more likely to explore ideas by being on a team. For questions 5 and 6 students feel that being on a team made them less likely to work at their own pace and do research.

► POST-STUDY Mean - After working on a team project students felt more positive about working on a team compared to alone. Students perceived themselves more creative, successful and more likely to do research. However, students did grow to feel slightly less receptive to exploring ideas and less comfortable to ask for help.

► Summary Mean - Creative Flexibility was not gained by being on a team, yet students perceptions grew to be positive toward being on team projects. Students perceived themselves more creative, successful and more likely to do research.
Data analysis

RQ1 - Are higher education students in project based learning environments more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment?

Summary

Hypothesis HO1 - Higher education students in project based learning environments are more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment.

PRE-STUDY t test of the study’s two primary groups, juniors and senior, was conducted indicating a value of .005 for exploring ideas on a team and a value of .007 for doing more research on a team compared to working alone. The hypothesis is rejected in these two cases therefore showing students are less likely to gain in creative flexibility on a team. However for the remaining seven questions the hypothesis fails to be rejected indicating that students are more likely to be more creative, motivated, successful, comfortable at asking questions and being productive on a team.

POST STUDY t test value of .017 for question 2 revealed that junior and senior students are less likely to have creative flexibility on a team, while a value of .009 for question 8 shows students feeling less likely to ask for help. Thus, the hypothesis is rejected for questions 2 and 8. Yet, for the remaining questions 1, 3-7 the t test values were greater than .05, so the hypothesis fails to be rejected in those case. Students on a team perceived themselves more creative, motivated.

T-test summary - Both studies showed that junior and senior students are less likely to gain creative flexibility on a team. However the data suggest that junior and senior students on a team perceived themselves more creative, motivated, became more open to do research on a team and less comfortable asking for help on a team.
Data analysis

RQ2 - Does a specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone?

<table>
<thead>
<tr>
<th>Descriptive Statistics Pre-Study</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>10. I feel the more students on the team the more creative team solutions</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>10. I feel the more students on the team the more creative team solutions</td>
<td>20</td>
</tr>
</tbody>
</table>
Data analysis

RQ2 - Does a specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone?

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<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>11. I feel that teams of 4 or more allows students to effectively manage the creative process</td>
<td>20</td>
</tr>
<tr>
<td>12. I feel that teams of 4 or more allows students to effectively team to communicate with others creative ideas</td>
<td>20</td>
</tr>
<tr>
<td>13. I feel that teams of 4 or more students encourages students to engage less in the creative process</td>
<td>20</td>
</tr>
<tr>
<td>14. I feel that teams of 2-3 students allows students to effectively manage the creative process</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Descriptive Statistics Post-Study</th>
<th>N</th>
<th>Minimu</th>
<th>Maximu</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. I feel that teams of 4 or more students allows students to effectively manage the creative process</td>
<td>20</td>
<td>1.00</td>
<td>5.00</td>
<td>3.4000</td>
<td>1.04630</td>
</tr>
<tr>
<td>12. I feel that teams of 4 or more students allows students to effectively communicate with others creative ideas</td>
<td>20</td>
<td>1.00</td>
<td>5.00</td>
<td>3.3000</td>
<td>1.12858</td>
</tr>
<tr>
<td>13. I feel that teams of 4 or more students encourages students to engage less in the creative process</td>
<td>20</td>
<td>2.00</td>
<td>5.00</td>
<td>2.6500</td>
<td>.98809</td>
</tr>
<tr>
<td>14. I feel that teams of 2-3 students allows students to effectively manage the creative process</td>
<td>20</td>
<td>1.00</td>
<td>4.00</td>
<td>2.2000</td>
<td>.69585</td>
</tr>
</tbody>
</table>
### Data analysis

**RQ2 - Does a specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone?**

<table>
<thead>
<tr>
<th>Question</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. I feel that teams of 2-3 students allows students the effectively communicate with other creative ideas</td>
<td>20</td>
<td>1.00</td>
<td>3.00</td>
<td>1.950</td>
<td>.51042</td>
</tr>
<tr>
<td>16. I feel that teams of 2-3 students encourages students to engage less in the creative process</td>
<td>20</td>
<td>2.00</td>
<td>4.00</td>
<td>3.650</td>
<td>.74516</td>
</tr>
<tr>
<td>17. I feel that teams of 4 or more students limits teammates from being able to have frequent and positive interactions as a student team</td>
<td>20</td>
<td>1.00</td>
<td>4.00</td>
<td>2.300</td>
<td>1.12858</td>
</tr>
<tr>
<td>18. I feel that teams of 2-3 students limits teammates from being able to have frequent and positive interactions with team</td>
<td>20</td>
<td>1.00</td>
<td>4.00</td>
<td>2.350</td>
<td>1.03999</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. I feel that teams of 2-3 students allows students to effectively communicate with others creative ideas</td>
<td>20</td>
<td>1.00</td>
<td>4.00</td>
<td>2.100</td>
<td>.71818</td>
</tr>
<tr>
<td>16. I feel that teams of 2-3 students encourages students to engage less in the creative process</td>
<td>20</td>
<td>2.00</td>
<td>4.00</td>
<td>3.350</td>
<td>.93330</td>
</tr>
<tr>
<td>17. I feel that teams of 4 or more students limits teammates from being able to have positive and frequent interactions as a student team</td>
<td>20</td>
<td>1.00</td>
<td>4.00</td>
<td>2.400</td>
<td>1.04630</td>
</tr>
<tr>
<td>18. I feel that teams of 2-3 students limits teammates from being able to have frequent and positive interactions with team</td>
<td>20</td>
<td>1.00</td>
<td>4.00</td>
<td>2.450</td>
<td>.99868</td>
</tr>
</tbody>
</table>
Data analysis

RQ2 - Does a specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone?

- **Summary**
- **Reliability** - A Chronbach's Alpha reliability test was conducted for the pre-study questions that produced a value of .568, which indicated that the construct is reliable. The Chronbach's Alpha reliability test for post-study questions showed a .625 value, which indicates reliability.

- **PRE-STUDY Mean** - The means for questions 14 and 15 indicate that students agree that 2-3 student teams effectively manage and communicate creative idea. Furthermore, the mean for questions 17 and 18 show students lean toward agreeing that both team sizes of 4 or more and 2 to 3 students limits frequent and positive interactions. On the other hand, for questions 10, 11, 12 and 16 students lean from neutral to negative in feeling that more students make a team creative and whether teams of 4 or more or 2 to 3 students can not effectively manage and communicate the creative process. For question 13 students leaned toward neutral on 4 or more student teams encouraging engagement.

- **POST-STUDY Mean** - For questions 10, 11, 12 and 16 students moved their perceptions from negative to neutral on having more people on a team. This shows students gained acceptance of large groups. However, questions 17 and 18 responses suggest that students perceptions changed toward neutral on small and large teams on being able to have frequent and positive interactions with team.

- **Summary Mean** - Students initially had a negative perception toward 4 or more student teams and a positive perception of 2 to 3 student teams. However, after participating on a team project student perceptions changed toward a more positive outlook on large teams. With that said student perceptions grew less favorable toward large and small teams being able to have positive and frequent team interactions.
Data analysis

RQ2 - Does a specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone?

- **Summary**

- **Hypothesis HO2** - A specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone.

- **PRE-STUDY t test** - All the questions from 10 to 18 with the exception of question 16 have t test values greater than .05. Therefore, the t test of juniors and seniors showed that the hypothesis is accepted, that is a specific team size enhances creativity by encouraging creative flexibility. Yet, junior and senior students suggest that teams of 4 or more and 2 to 3 students enhance creativity by way of creative flexibility. Question 16’s t test value of .019 suggests no specific team size enhances creativity.

- **POST-STUDY t test** - T test values for questions 10 (.843), 11 (.329), 12 (.181) and 13 (.059) are greater than .05 thus, the hypothesis fails to be rejected. Therefore, indicating that a specific team size does enhance creativity by encouraging creative flexibility. In our study’s case 4 or more students on a team enhance creativity through creative flexibility. However, the t test values for questions 14 (.003), 15 (.003), 16 (.018) and 18 (.001) were less than .05, suggesting that the hypothesis be rejected in those cases. Indicating that team sizes, such as 2 to 3 students in our study, do not encourage creativity flexibility.

- **T test summary** - The t test values suggest that junior and senior students at the beginning of the team project felt that both teams of 4 or more and 2 to 3 students encourage students to be creative by way of creative flexibility compared to working alone. However after the project these student perceptions changed to be more favorable of 4 or more student teams.
Data analysis

RQ3 - Of the various life skills, such as communication, time management, and critical thinking, which are enhanced more when students work in teams compared to working alone?

<table>
<thead>
<tr>
<th>Descriptive Statistics Pre-Study</th>
<th>Descriptive Statistics Post-Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>19. Being part of a student team project assignment has improved my communication skills with others</td>
<td>19. Being part of a student team project assignment has improved my communication skills with others</td>
</tr>
<tr>
<td>N: 20; Min: 1.00; Max: 3.00; Mean: 2.0000; Std. Deviation: .64889</td>
<td>N: 20; Min: 1.00; Max: 3.00; Mean: 2.0000; Std. Deviation: .45883</td>
</tr>
<tr>
<td>20. Being part of a student team assignment has improved my problem solving skills</td>
<td>20. Being part of a student team project assignment has improved my problem solving skills</td>
</tr>
<tr>
<td>N: 20; Min: 1.00; Max: 4.00; Mean: 2.1500; Std. Deviation: .74516</td>
<td>N: 20; Min: 1.00; Max: 4.00; Mean: 2.4500; Std. Deviation: .82558</td>
</tr>
<tr>
<td>21. Being part of a student team project assignment has improved my time management skills</td>
<td>21. Being part of a student team project assignment has improved my time management skills</td>
</tr>
<tr>
<td>N: 20; Min: 1.00; Max: 5.00; Mean: 2.5000; Std. Deviation: 1.14708</td>
<td>N: 20; Min: 2.00; Max: 4.00; Mean: 2.4500; Std. Deviation: .82558</td>
</tr>
<tr>
<td>22. Being part of a student team project assignment has improved my decision making with others</td>
<td>22. Being part of a student team project assignment has improved my decision making with others</td>
</tr>
<tr>
<td>N: 20; Min: 1.00; Max: 4.00; Mean: 2.3000; Std. Deviation: .86450</td>
<td>N: 20; Min: 2.00; Max: 4.00; Mean: 2.3000; Std. Deviation: .57124</td>
</tr>
</tbody>
</table>
Data analysis

RQ3 - Of the various life skills, such as communication, time management, and critical thinking, which are enhanced more when students work in teams compared to working alone?

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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>23. Being part of a student team project assignment has made me to take a greater ownership of my learning</td>
<td>20</td>
</tr>
<tr>
<td>24. Being part of a student team project has made me more cognizant of my own strengths, weaknesses and interests</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>23. Being part of a student team project assignment has made me to take greater ownership of my learning</td>
<td>20</td>
</tr>
<tr>
<td>24. Being part of a student team project has made me more cognizant of my own strengths, weaknesses and interests</td>
<td>20</td>
</tr>
</tbody>
</table>

Data analysis

RQ3 - Of the various life skills, such as communication, time management, and critical thinking, which are enhanced more when students work in teams compared to working alone?
Data analysis

RQ3 - Of the various life skills, such as communication, time management, and critical thinking, which are enhanced more when students work in teams compared to working alone?

- **Summary**
- **Reliability** - A Chronbach’s Alpha reliability test was conducted for the pre-study questions that produced a value of .853, which indicated that the construct is reliable. The Chronbach’s Alpha reliability test for post-study questions showed a .834 value, which also indicates reliability.

- **PRE-STUDY Mean** - The mean for questions 19, 20, 22 and 24 indicate that students agree that being on a team will improve their communication, problem solving, decision making and awareness of own strengths, weaknesses and interests. Yet, for questions 21 and 23 students were leaning toward being neutral on whether being on a team enhanced ownership of learning and time management skills.

- **POST STUDY Mean** - The means for questions 19 and 22 suggest that students agree that communication and decision making skills are enhanced on a team. The means for questions 20, 21, 23 and 24 suggests that students were leaning toward being neutral on whether being on a team improves problem solving, time management, ownership of learning and cognition of strengths, weaknesses and interests.

- **Summary** - Students before the project were more optimistic about teams enhancing problem solving compared to working alone. Student perceptions of time management and ownership of learning remained neutral. However, even after the project students perception of decision making and communication skills remained untouched. In other words those two life skills were not influenced or enhanced on a student team compared to working alone.
Data analysis

RQ3 - Of the various life skills, such as communication, time management, and critical thinking, which are enhanced more when students work in teams compared to working alone?

- **Summary**

- **Hypothesis HO3** - Various life skills, such as communication, time management, and critical thinking, are enhanced when students work in teams compared to working alone.

- **PRE-STUDY t test** - Question 20’s t test value of .003 shows that junior and senior students perceive being part of a student team project assignment will likely not provide greater ownership of learning. Thus, the hypothesis is rejected for question 20. However, the t test values for questions 19, 21 thru 24 are greater than .05, therefore the hypothesis fails to be rejected. Life skills are enhanced when on a student team.

- **POST-STUDY t test** - For questions 20 thru 23 the t test showed values greater than .05, thus in those cases the hypothesis fails to be rejected. Therefore life skills are enhanced when on a team. Students take greater ownership of their learning and improve their decision making with others, time management and problem solving skills. Question 19’s t test value of .009 shows that junior and senior students working on team projects perceive themselves to be less cognizant of their own strengths, weaknesses and interests. Furthermore, a t test value of .045 for question 24 suggests that students were less likely to improve their communication skills. Thus, the hypothesis is rejected for questions 19 and 24.

- **T test summary** - Both studies showed t test values that suggest students life skills are enhanced by being on a team, such as decision making, time management and problem solving. With that said ownership of learning was perceived to have gained while on a team, yet students become less skilled at communicating creative ideas and cognizant of their own strengths, weaknesses and interests while on a team.
Data analysis

Qualitative survey question: List two items that you perceived to be better about working with student teams as opposed to working alone?

- The before and after projects had similar tones and responses. The following represents a sample of student qualitative survey question 25 responses:

  - Theme creativity and creative flexibility:
    - Six student responses (student 1-3 and 7-9) shared a similar sentiment “variety and ideas” and “ideas and diversity” were the two best issues about working on a team as opposed to working alone.
    - Student four stated “Working with student groups allows us to learn more because of the extra help. This also allows students to come up with a more creative solution”.
    - Student 19 stated “The team gets more varied and sometimes better ideas as a group. 2. If you hit a wall, ideas-wise, being in a group can help because you can bounce ideas off of other people”.
    - Student five feels “like I’m learning "a little about a lot" instead of "a lot about a little"

  - Theme team interactions:
    - Student eleven indicated “variety and teammates”.
    - Student six stated “A collaboration of ideas and makes me be a better leader”. I have learned more about myself when I work in groups. I am the type of person who likes to be in control of the whole project.

  - Theme communication with others:
    - Student 12 stated “It is fun to bounce off ideas and develop them further than you could on your. It is fun to learn have people with different skills, so you have more tools to your advantage than you might have on your own”.

  - Theme time management:
    - Student 14 indicated “There is more available creativity/ideas, and time management is better because you have to accommodate other people”.
    - Student 18 stated “I feel like my time management skills, energy, and team work skills have improved”.
Data analysis

Qualitative survey question: List two items that you perceived to be worse about working with student teams as opposed to working alone?

- The responses for before and after project had similar tones and themes. The following represents a sample of student qualitative survey question 26 responses:

- Theme teams are good no matter what:
  - Students 1, 5, 7 and 10 shared the same view by stating that “nothing” is negative about student teams”.

- Theme team size:
  - Student six indicated “some people don’t carry their own weight, sometimes different personalities have difficulty working together”.
  - Student 12 stated “many students do not make themselves available for group projects so it is hard to communicate and build ideas. The work load is usually not divided equally”.

- Theme time management/ interactions:
  - Students 2, 3, 8 and 9 gave the same response “people, dependency and schedules”.
  - Student 15 indicated “hard to find time out of class, have to compromise on decisions even if you like your idea better”. Suggesting that people’s personalities and dependency on the schedule of others is a problem.
  - Student 16 indicated “finding time to work on the project have to compromise on what you want to do”.
  - Student 4 stated “usually a lot of time is wasted. Some individuals don’t get to voice their opinion”.
  - Student 15 stated “One person ends up doing the most work. No one wants to meet; most everyone wants to only communicate through Googledoc or GroupMe message”.

- Theme creative flexibility:
  - Student 13 stated “I can’t be consumed in my own thoughts/opinions as when I can be when I have group members influencing my thoughts. I find that it can be a little bit scatter brained and less of a stream line of thinking”.
  - Student 18 indicated “I think that it is hard to really give input in a situation when a decision has already been made. It can be intimidating working with a group of unfamiliar people and feeling like it is okay to contribute and even make mistakes”.
  - Student 19 stated “A lot of people can have a lot of different ideas, and it can sometimes be unproductive. 2. Some members of the group might not be as on top of their work assigned to them, and might make others in the group have to pay for their actions”.
Conclusion

- RQ1- Are higher education students in project based learning environments more likely to gain in creative flexibility when working in student teams compared to when working alone on a course assignment?

  - The quantitative findings suggest that creative flexibility or the exploration of various ideas is no more likely to be gained when working in student teams or working alone. With that said students more likely to perceive themselves as creative, successful, motivated and more open to do research when in a team compared to working alone. Yet, in terms of asking for help the students are less comfortable asking for help on a team compared to working alone.

  - The qualitative findings support the quantitative outcome that students feel more creative in a group because members are exposed to a variety of ideas. However students are not encouraged to explore many ideas because their teammates will provide them with various ideas and then teammates bounce these creative ideas off each other. Furthermore, working with individuals that you are not familiar with can be intimidating as stated by a student participant. As such students may be reluctant to voice their ideas. Furthermore, another possibility for the lack of creative flexibility is as a student indicated that there is a lot of wasted time that occurs on teams as a result discouraging individuals from voicing their creative ideas because that takes additional time.

  - However, creativity does occur within a team because student teams allow students to learn from the actions and knowledge of fellow teammates and because the work is divided up students have more time to make decisions, problem solve and create. The result is a more creative solution based on collaboration. As one student stated “like I'm learning “a little about a lot” instead of “a lot about a little”
Conclusion

- RQ2 - Does a specific team size enhance creativity by encouraging students to generate a wider variety of ideas compared to students working alone?

  Quantitative findings suggest that student team members as they progressed through the project gained acceptance of 4 or more student teams and end with a more positive attitude toward 4 or more student teams than 2 to 3 student teams. Yet, students also felt that with both 4 or more students and 2 to 3 student teams it was difficult to have positive and frequent team interactions. The researcher postulates that because of individuals different personal and academic obligations it may be challenging for team members to schedule meetings outside of class.

  Based on the participants’ response, which did not signal out a particular team size the qualitative findings suggest that the number of students on a team does not matter. Although the qualitative findings do not mention specific team size the findings nevertheless suggest that what influences and enhances creativity is teammate interactions - a student’s willingness to do their share of the work, commit time to the project, student’s ability to get along with teammates, effective communication and a willingness to compromise with others. In summary both qualitative and quantitative findings suggest although many ideas a developed and discussed because the team has various members, the findings suggest that a specific team size does not enhance creativity rather it is the inner workings of the team members.
Conclusion

- RQ3 - Of the various life skills, such as communication, time management, and critical thinking, which are enhanced more when students work in teams compared to working alone?

  - Quantitative findings showed that student life skills are enhanced when students working in teams, particularly decision making, problem solving, time management and communication skills are enhanced on a team compared to working alone. While on a team students gained ownership of their learning compared to working alone. Yet students become less skilled at communicating creative ideas and cognizant of their own strengths, weaknesses and interests while on a team. The researcher postulates that students might become less skilled at communicating creative ideas as the more complex the ideas are. In terms of recognizing their own strengths and weaknesses, students agree to take on tasks according to the need of the team and student’s availability to do the task, which ties back to students having difficulty in scheduling frequent and positive interactions with team members.

  - The qualitative and quantitative findings support each other in that they show that life skills are enhanced more with student teams compared to working alone. The findings showed that student’s team members gained leadership skills, collaboration proficiency and problem solving ideas. Furthermore, through the observation of their teammates’ different skill sets students learned to use those available skills to the team’s advantage, which would not of happened if the student worked on their own. Because students had difficulty meeting outside of class due to conflicting schedules, students had their time management skills, energy, and team work skills improved. As a student stated “time management is better because you have to accommodate other people”.


References

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