Using your Brain to Build Teams that Work:
A Study of the Freshman and Sophomore Engineering Clinics at Rowan
University

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Abstract
This paper discusses the results of the first semester of a longitudinal study of intentional
teambuilding undertaken in the Freshman and Sophomore Engineering Clinics at Rowan
University. Students took Johnston & Dainton’s *Learning Combination Inventory*1 (LCI), a 28-
item self-report instrument that quantitatively and qualitatively captures the degree to which an
individual uses each of four learning patterns. Through these patterns the learner represents how
he or she sees the world, takes in stimuli, integrates the stimuli and formulates a response to it.
An individual can begin his or her learning with a particular pattern or patterns, use patterns as
needed, or avoid them. Teams were then created in order to maximize individual and collective
use of learning patterns. This paper will report
1. The results of the initial study conducted during the Fall 2001 semester.
2. An overview of the patterns that resulted from the administration of the LCI to all Freshmen
and Sophomore Engineering students at Rowan
3. Examples of the patterns of the teams that were assigned (to show how it’s done)
4. Comments from students regarding their team experiences
5. An evaluation of the study to date.

Introduction
Responding to the demands of industry for graduates skilled in teamwork, many engineering
programs have introduced projects that require students to work in teams2. Positive team
experiences also contribute significantly to student academic success and to improved rates of
retention3. Creating teams, however, does not always engender effective team behavior4.
Students who report negative team experiences typically cite lack of communication among –
and lack of commitment by – some participants as factors critical to unproductive or failed work
efforts5.

Nationwide there is increasing interest in the subject of forming teams on the basis of
qualifications that are more closely associated with individual learning patterns than with
specific technical qualifications alone6. Of course, it is important to take into consideration the
actual technical skills that a particular member brings to a project team but if the team members
do not adequately function as an effective unit, the technical skills will be wasted. The *act of
forming effective teams*, then, should be emphasized as an important technical skill.
The Freshman and Sophomore Clinics at Rowan University

The Freshman and Sophomore Clinics at Rowan University are intensive, team-based and multi-disciplinary laboratory courses taken by all engineering students in the college. The Freshman Clinic is taught by engineering faculty from each of the four disciplines at Rowan: Mechanical, Electrical and Computer, Civil and Environmental, and Chemical. It targets problem solving and engineering measurements in the fall semester and introduction to design and competitive assessment in the spring semester. In Freshman Clinic, we have concentrated on using teams to build a feeling of belonging among the first year Engineering students who are mostly in classes outside of the college.

We begin with the first day of class in the fall when teams of 4 or 5 students are asked to participate in a tower building contest using Jenga blocks. This first day exercise allows the students to get to know some of the people in their section and to become acquainted with their section instructor in an informal atmosphere. During the remainder of the semester, the students work in teams on laboratory projects, presentations, and in homework study-groups.

Sophomore Clinic is team-taught by faculty from engineering and college writing in the fall semester and faculty from engineering and public speaking in the spring. The curriculum in Sophomore Clinic is coordinated so that the students’ writing and speaking assignments are planned and accomplished in conjunction with the laboratory design projects that increase in sophistication during the academic year.

At the completion of these first two years of Engineering Clinic, the students must be prepared to work on design projects in mixed teams of junior and senior students throughout the remainder of their undergraduate program. During the Junior and Senior years the students are expected to perform at a near-professional level on industry and government sponsored projects. Throughout the Clinic sequence, the effective performance of the students’ team is crucial to their success.

While team performance is critical in each of the Rowan Engineering disciplines, the development of models for effective team building needs more attention. We actively encourage the students to participate in their teams, but we do not provide extensive formal instruction in team management or team interaction skills. Some topics relevant to teamwork, such as brainstorming or dealing with difficult people, are addressed, however, the details of team interaction are not specific lecture or discussion topics. In addition, there has been no systematic attempt to form teams on a consistent basis. We have sometimes tried to group students based on perceived strength by assuring that all the strong students do not end up in a single group. Another consideration which has been used in the past is to assure that no team had only one woman student. It was felt that the women would be more comfortable in a predominately male environment if they were not isolated. A new method that combines consideration of the students’ strengths, preferences and needs with information that the students can use to improve their group experience will be a welcome addition to the engineering program at Rowan University.
The Study: Using the LCI to build teams in Freshman and Sophomore Clinic

In the summer of 2001 Freshman and Sophomore Clinic faculty worked with educational researchers at Rowan University’s Center for the Advancement of Learning to strengthen team effectiveness by building teams based on learning. The underlying assumption of our plan to create learner-based teams was this: team members’ need to understand themselves and others was fundamental to successful teaming. Johnston’s Interactive Learning Model (ILM) was chosen for the study. It is a brain-based learning model, which uses a reporting instrument, or Learning Combination Inventory (LCI) and a process (the Let Me Learn Process®) to frame and facilitate individual and group learning. The theoretical basis of the ILM is a set of constructs establishing cognition, conation, and affection as the touchstones of the brain’s synchronization of the learning process.

The ILM suggests that how an individual learns manifests itself observably in four behavioral learning processes or patterns: Sequential, Precise, Technical and Confluent. These patterns represent how the learner sees the world, takes in stimuli, integrates the stimuli and formulates a response to it. An individual can begin his or her learning with a particular pattern or patterns (reflected in LCI scores of 25-35), use patterns as needed (reflected in LCI scores of 17-24), or avoid them (reflected in LCI scores of 7-16). Table 1 summarizes the basic indicators of each pattern.

Table 1. ILM Learning Pattern characteristics

<table>
<thead>
<tr>
<th>Cognitively</th>
<th>Conatively</th>
<th>Affectively</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sequential</strong></td>
<td>I organize information</td>
<td>I make lists</td>
</tr>
<tr>
<td></td>
<td>I mentally analyze data</td>
<td>I organize</td>
</tr>
<tr>
<td></td>
<td>I break tasks down into steps</td>
<td>I plan first, then act</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Precise</strong></td>
<td>I research information</td>
<td>I challenge statements and ideas that I doubt</td>
</tr>
<tr>
<td></td>
<td>I ask lots of questions</td>
<td>I prove I am right</td>
</tr>
<tr>
<td></td>
<td>I always want to know more</td>
<td>I document my research and findings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I write things down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I write long e-mail messages and leave long voice mail messages</td>
</tr>
<tr>
<td><strong>Technical</strong></td>
<td>I seek concrete relevance – what does this mean in the real world?</td>
<td>I get my hands on</td>
</tr>
<tr>
<td></td>
<td>I only want as much information as I need – nothing extraneous</td>
<td>I tinker</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I solve the problem</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I do</td>
</tr>
<tr>
<td><strong>Confluent</strong></td>
<td>I read between the lines</td>
<td>I take risks</td>
</tr>
<tr>
<td></td>
<td>I think outside the box</td>
<td>I am not afraid to fail</td>
</tr>
<tr>
<td></td>
<td>I brainstorm</td>
<td>I talk about things – a lot</td>
</tr>
<tr>
<td></td>
<td>I make obscure connections between things that are seemingly unrelated</td>
<td>I might start things and not finish them</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I will start a task first – then ask for directions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Learning Combination Inventory (LCI) is a 28-item self-report instrument that quantitatively and qualitatively captures the degree to which an individual uses each of the four learning patterns. Nationally and internationally validated, the LCI has test-retest reliability as...
well as content, construct, and predictive validity. It has a track record as an effective tool for building teams in industry in the United States and abroad.

The ILM assumes that if an individual knows his or her set of integrated learning patterns, then he/she can use that knowledge to attend to the learning task, respond to the learning task and develop a sense of achievement about the learning task. This, in turn, propels him/her into the next activity with a sense of efficacy. Rather than being acted upon as a passive recipient of information, the learner takes control of the responsibility for making learning work. Here the conceptualization moves from the internal mental functions and operations of the individual to the external world social operations within a teaching-learning context.

Using the LCI as a Teambuilding Tool

The operational model for using the LCI as a teambuilding tool assumes that taking control of how to make learning work is a powerful and positive learning experience for the learner. In team learning, research suggests that group success occurs more readily when the group consists of individuals who collectively have a “Use First” level in each of the four patterns. In addition, whenever there is a large disparity in learning pattern scores between individuals there should be a “bridge” team member who can mediate between extremes to promote understanding of learning strengths. An exception to the rule is the “Strong-willed Learners”, who use three or more patterns at a “Use First” level. Each of these learners is his or her “own team”, that is, an individual who can work effectively alone (and often prefers to do so) or who often dominates a group. Research indicates that Strong Willed Learners should constitute separate teams of 4 or more. Sometimes this requires additional attention to conflict resolution techniques, but it also tends to minimize the extent to which one learner can dominate a group.

Awareness of the individual as a learner, not teaching modalities, fosters a true learning community and academic success. While simply grouping team members by their LCI scores may reflect academic or task success due to shared strengths in each of the patterns, it is the understanding of each other’s learning patterns and the intentional use of each individual’s strengths that makes for the collective achievement of the team.

The Research Design

In the fall of 2001, 220 students and 12 faculty in the Freshman and Sophomore Clinics were given the Learning Combination Inventory (LCI). The LCI’s were validated and the results were used to build collective learning profiles of each cohort and of each Engineering section within a cohort. Collective learning profiles are tools that enable the instructor and the class to understand the diversity of learning patterns within the cohort or the classroom, and to devise strategies for communicating in learning situations.

Collective Cohort Profiles

We used Excel to log and analyze the LCI data. Tables 2 and 3 provide collective profiles for the two student cohorts, while Table 4 shows faculty data.
Table 2. Rowan University Freshman Engineering Clinic 2001

<table>
<thead>
<tr>
<th></th>
<th>Sequence</th>
<th>Precision</th>
<th>Technical</th>
<th>Confluent</th>
<th>Use</th>
<th>First</th>
<th>Avoid</th>
<th>Id</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>25.3</td>
<td>21.4</td>
<td>27.9</td>
<td>22.1</td>
<td>S</td>
<td>71</td>
<td>15</td>
<td>98</td>
</tr>
<tr>
<td>Median</td>
<td>25.5</td>
<td>21</td>
<td>28</td>
<td>22</td>
<td>P</td>
<td>15</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Mode</td>
<td>26</td>
<td>19</td>
<td>25</td>
<td>22</td>
<td>T</td>
<td>15</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>N=126</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Rowan University Sophomore Engineering Clinic 2001

<table>
<thead>
<tr>
<th></th>
<th>Sequence</th>
<th>Precision</th>
<th>Technical</th>
<th>Confluent</th>
<th>Use</th>
<th>First</th>
<th>Avoid</th>
<th>Id</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>26.4</td>
<td>20.5</td>
<td>29.3</td>
<td>22.3</td>
<td>S</td>
<td>67</td>
<td>18</td>
<td>79</td>
</tr>
<tr>
<td>Median</td>
<td>27</td>
<td>20</td>
<td>30</td>
<td>22</td>
<td>P</td>
<td>79</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>Mode</td>
<td>29</td>
<td>19</td>
<td>34</td>
<td>22</td>
<td>T</td>
<td>3</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>N=94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Rowan University Freshman & Sophomore Engineering Faculty

<table>
<thead>
<tr>
<th></th>
<th>Sequence</th>
<th>Precision</th>
<th>Technical</th>
<th>Confluent</th>
<th>Use</th>
<th>First</th>
<th>Avoid</th>
<th>Id</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>22.25</td>
<td>24.8</td>
<td>25.4</td>
<td>24.5</td>
<td>S</td>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Median</td>
<td>22</td>
<td>25.5</td>
<td>24.5</td>
<td>25</td>
<td>P</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Mode</td>
<td>18,22,24</td>
<td>22</td>
<td>24</td>
<td>25,26</td>
<td>T</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>N=12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Charting collective patterns was intended to help students and faculty to attend to areas where barriers to communication and learning could occur. For example, half of the faculty begins their learning with the pattern of Precision, while only 12% of freshmen use the pattern first and 12% avoid it. Since faculty tend to teach the way they learn, and since faculty expectations for student learning tend to be informed by the individual faculty member’s own learning patterns, it is useful for the faculty to be aware that some students may tend to feel overwhelmed with highly precise information. It is also useful to help students to strategize their learning or lab assignments by viewing samples of appropriate levels of detail from members of their team who use precision as needed.

Individual Class Profiles:

In addition to collective profiles, we created class/section profiles in which we analyzed for each professor the learning patterns and behaviors of his or her students. Table 5 juxtaposes the professor’s LCI scores against the individual class profile.
Table 5. Class Profile of a Sophomore Engineering Clinic, Section A

<table>
<thead>
<tr>
<th></th>
<th>S</th>
<th>P</th>
<th>T</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professor’s Scores</td>
<td>28</td>
<td>27</td>
<td>16</td>
<td>26</td>
</tr>
<tr>
<td>Class Mean</td>
<td>27.6</td>
<td>19.9</td>
<td>32.6</td>
<td>23</td>
</tr>
<tr>
<td>Class Median</td>
<td>27</td>
<td>20</td>
<td>35</td>
<td>22</td>
</tr>
<tr>
<td>Class Mode</td>
<td>26, 29</td>
<td>20, 23</td>
<td>34, 35</td>
<td>20, 21, 22</td>
</tr>
</tbody>
</table>

Class Profile and Recommendations

A recommendations report for each faculty member accompanied the profile. Here is an excerpt from the report for Sophomore Engineering Clinic, Section A:

The mean score of sequence for the class is 27.6. Over 70% of the class uses the pattern of sequence to begin their learning. This is a class that, as a whole, will require a substantive syllabus, clear, complete directions, and few to no changes once assignments have been made. As a consequence, you, as the professor will want to take your time giving careful step-by-step directions, repeating the directions, and allowing the students to double-check your expectations for the assignment. Providing samples of the work product you are seeking may help alleviate some of the students’ frustration or anxiousness... As a person who uses sequence at a higher level than the class mean (28), you are equipped to do a thoughtful check of how clear and consistent you are with your directions for assignments and projects. These folks, overall, want a plan and want to hold to that plan.

A more serious potential challenge in this class lies in the realm of precision. While your score, 27, falls in the “use first” range, the mean score for the class is 19.9. In addition, 4 students (28.6%) avoid using the pattern. These students may tend to feel overwhelmed with highly precise information. They will need to see samples of appropriate levels of detail from members of their team who use precision as needed. The highest scores for precision for some teams fall in the “use as needed range, since higher scores were scarce.

When combined with low scores for precision, the students’ high technical scores (mean= 32.6; mode=35; 100% of the class uses technical reasoning first), make writing assignments difficult. Instructional and team efforts to provide clear models of assignments, as well as assignments that allow the students to utilize their need for relevance or practical application should alleviate some of the frustrations which could affect the learning environment. The issue of communication within teams will need to be watched closely. The students will need to establish intentional lines of communication. Otherwise it may not occur. With an avoidance score of 16 in technical reasoning, these learning problems may need your greatest attention.

Team Profiles:
Teams were created in order to maximize individual and collective use of learning patterns. Our ideal team consisted of four students, each of whom could contribute a different “Use First” or “As Needed” pattern to a learning situation. We defined a balanced team as one in which students with “Use As Needed” scores (LCI scores of 17-24) in a particular pattern would be able to mediate between students whose scores fell in the “Use First” category (LCI scores of 25-35) and those who avoided a pattern (LCI scores of 7-16). Figure 1 represents the ideal team.
Since many of the engineering students had similar combinations of patterns, or at least tended to have high use scores in Sequence and Technical Reasoning, not every team could be built to ideal specifications. Nevertheless, each person was placed on a team on the basis of his or her ability and/or need to use each of the four patterns at a high level (“Use First”), as needed, or less frequently (“Avoid”). It was intended that leadership for task completion and delegation of specific tasks would change for each project or for any given component of a project, depending on its nature and design.

In addition, student teams were built to maximize and to balance the learning strengths that each team member would bring to the group. A total of 30 teams of 4 or 5 members in Freshman Clinic and 18 teams of 5 or 6 members in Sophomore Clinic were created. Each student received a personalized team profile like the one in Table 6.

<table>
<thead>
<tr>
<th>Table 6. Team Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team D</td>
</tr>
<tr>
<td>Student #1</td>
</tr>
<tr>
<td>Student #2</td>
</tr>
<tr>
<td>Student #3</td>
</tr>
<tr>
<td>Student #4</td>
</tr>
</tbody>
</table>

The Findings

Data from Entry Surveys

During the first week of the semester, the students completed entry surveys to provide baseline data on their attitudes toward teamwork, learning and engineering. Most of the freshmen came to Rowan with experience working in teams, but no one had ever been placed on a learning-based team. The majority reported that, in the past, teachers had used arbitrary methods such as self-selection and random assignment to create student teams. Most returning students enrolled in Sophomore Clinic reported expectations of choosing their own teams. Based on past experience, both good and bad, the sophomores had already learned whom they worked well with and wanted to stick with those teammates during their tenure in the undergraduate
program. Both freshmen and sophomores reported similar frustrations with past teamwork: lack of communication and failure to complete an equitable share of the workload by some team members. With the exception of 6 students who had never experienced a successful team, the rest (97%) agreed that the best team experiences had occurred when everyone contributed, communicated, and reached consensus without too much conflict.

At the same time that team assignments were made, the students received information on the ILM, their individual scores, those of their faculty, their team profile, and the reasons they were assigned to a team. They were also given instruction in how to use knowledge of patterns to decode assignments and to assign work tasks in laboratories.

Data from Mid-semester Surveys

A second workshop was held mid-semester to reinforce learning-based techniques for successful teamwork. At that time, all freshmen and a sampling of Sophomores (38%) were surveyed to collect data on the team experience. Among the sophomores, 38.9% reported better team configurations than in the previous year. Another 19.4% responded that their experience was positive, but roughly equivalent to their freshman year. It was too early for 11.1% to judge the new model. Finally, 30.6% of those surveyed reported a negative team experience, citing the unwieldy size of the teams (6 persons in some of the Sophomore clinics), disengagement (lack of commitment and communication) by some team members, and the lack of freedom to choose their friends as teammates as reasons for their negative assessments.

Survey results from freshmen were as follows: 69.2% reported positive and productive team experiences. Another 17.1% told us that three out of four team members contributed well to the team effort. For 3.4% of the freshman cohort it was too early to judge their team. Twelve students, or 10.3%, reported negative team experiences. The reasons given differed from those offered by dissatisfied sophomores. Four female students, the only ones on their respective teams, felt marginalized by their teammates and excluded from lab projects. Three non-resident students complained that teammates did not consider their circumstances when scheduling work or study sessions. Five students said that knowledge of learning patterns did not always help when dealing with a “problem” teammate (one who did no work but tried to dominate labs and benefited from the credit earned by teammates).

Anecdotal Data

Anecdotal data enables us to understand the subtleties of some of the students’ responses. Typical positive responses to the question, how is your team working, were:

- In all honesty, this group works very well together. We work as a team and get things done (male freshman).

- Each of us has special abilities, and it’s always good to share opinions (male freshman).

- With a good team you can accomplish everything (male sophomore).

- The teaming model helped us to get to know each other. We got on teams with people we would normally not work with (female sophomore).
Typical negative responses to the same question were:

- There were too many of us to get everything done where everyone puts in the same effort (male sophomore).
- One person did no work and took credit for the project (male freshman).
- Two of the six members never showed up (female sophomore).

**Data from Exit Surveys**

Surveys administered at the end of the semester yielded additional data on the students’ experience working in intentionally constructed teams. Specifically, the surveys were seeking to measure the students’ assessment of team skills and the impact of their intentional use of learning patterns on teamwork. The breakdown of student responses to the question of how successful teams was as follows: Of the 109 freshmen who answered the survey, 68.8% said their teams were successful or highly successful in completing projects in which all contributed and communication was good. Another 18.4% said that, for the most part, or with the exception of one team member, the teams were successful. 12.8% of freshmen reported primarily negative experiences with teams. The team that registered the most and loudest complaints was not intentionally constructed on the basis of learning patterns. Rather, it was constructed for expediency from students who had missed out on the original teaming. Half of the other negative assessments came from members of teams of strong-willed learners who would have preferred to work alone.

Of the 82 Sophomores who answered the survey, 48.8% rated their teams successful or highly successful. Another 30.5% reported qualified success (complaints about one member or times at which communications broke down, but assignments were completed). 20.7% of the sophomores characterized their teams as unsuccessful.

**Anecdotal Data from Exit surveys:**

Typical positive responses to the question, how did your team work, were:

- The selection of teammates was key and in my opinion was worth the time identifying learning patterns. We all got along and worked well together (male sophomore).

- I would want to be on other teams built on the LCI so that I don’t get stuck with a team that can’t do a specific task (female sophomore).

- I felt well paired with team members. The balance of opinions prevented mutiny (male freshman).

- We all had important qualities to contribute to the group (female freshman).

- I believe these patterns help organize groups and learning better (female freshman).

- My group assignments made it easier to learn because my peers could reword things I didn’t understand. We fit perfectly (male freshman).

- It groups the right people together so we can get things done effectively (male freshman).
I learned while working with my group that my learning patterns were actually true and that each group member was able to compliment the other (male sophomore).

The only course which used learning patterns was Engineering, but I feel this helped me for all my courses in general (male freshman).

I would like to take other courses [in which the LCI was used] because it means that they actually care about how we learn and want to help us to learn better (female sophomore).

On the negative side:
- While my team worked well, the course itself was boring and the focus on learning meaningless (male sophomore).
- We were put on a team because we didn’t fit into other groups. It didn’t work (female freshman).
- While having knowledge of learning patterns was good, I was not satisfied with my team. People were not able to get together (male freshman).
- I had to switch groups mid-semester because my first group didn’t allow me to participate in the labs. My second group was great (female freshman).
- My team did not work effectively. 2 or 3 students ended up doing all the work because others couldn’t be trusted (male sophomore).
- In a personal sense the information about learning patterns was useful. In a practical sense, useless because no one associated with my final grade has used this information in their instruction (male sophomore).

Conclusion
While it is perhaps a tactical mistake to end with negative comments, they do provide the framework for examining where we have been and what needs to be done next. For the freshmen the learning-based teaming experience was significantly more positive than it was for sophomores who had expected to be able to self-select team members. Freshman frustrations with teamwork tended to focus on individual team members who did not contribute equitably, rather than on the process used to construct teams. The other significant complaint, which seemed louder than those heard last year, came from women who were alone on teams. We did not consider gender in the team building and have had more complaints about the Clinic this year than in the past.

The sophomores were generally more critical of the whole Clinic experience than the freshmen, reporting that the labs did not focus enough on design, the work load was too great for the number of credits granted, the professors were not as well organized as they should be, and that most of the faculty for sophomore engineering (as opposed to writing) labs paid no attention to learning issues, so any effort to make the students focus on learning was a waste of valuable time. Sophomore criticisms of the learner-centered teambuilding model are not to be discounted, but they must also be placed in the context of the mental models that sophomores brought to the Clinic setting.

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We need to listen to these comments in order to improve the teaming experience. While organizing teams on the basis of learning patterns was helpful to the majority of Rowan engineering students, we need, first, to arrive at a consensus as to what constitutes a successful team. We also need to teach teambuilding skills more intentionally. We need to refine the means by which faculty and students alike can assess and continuously improve the team experience. A future study will seek to link LCI profiles to other measures of team success in addition to the team self reports. Finally, there are additional factors which need to be considered along with learning patterns: gender ratio, the needs of commuters versus resident students, and -- in Sophomore Clinic -- balancing teams in terms of majors.

Faculty response to the teambuilding experience was also mixed. As we described in our discussion of the research design, the faculty took the LCI and participated in a discussion session based on the analysis of the results. Most, however, felt that more information and guidance would be required to make effective use of the results of the LCI as a learning tool in the classroom. The most often expressed desire of the faculty was to have training in team assessment and intervention skills. These skills would allow the faculty to make the team experience more than a mechanism for accomplishing a project but an opportunity for reflection and growth.

In the academic engineering disciplines we hope to communicate to our students the basics of effective team participation. It is crucial that we are able to give the students both an effective team experience by forming student teams that succeed and by giving them the tools to form and analyze team behavior. Engineering educators must determine what team skills students need. They must also understand how to teach and assess those skills. And, finally, they must build teams purposefully. Intentional conceptualization of teams and teamwork is the first step toward building teams that work.

References