DRSS

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Dayton Regional STEM School
2010 Knowledge Capture Project

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Social Science Observation & Ethnographic Knowledge Capture of 9th Grade Global Climate Change Project Spring 2010

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Overview

The first cohort of ninth grade students at the Dayton Regional STEM School (DRSS) participated in projects based on a Global Climate Change (GCC) unit throughout April and May 2010. Eighteen [18] projects based on GCC were designated, and students ranked their first three choices. The 73 students were then assigned to one of the 18 groups coached by the five DRSS teachers, the DRSS principal, other staff members, and volunteers. The unit involved two weeks of cross-curricular instruction in content area classes at DRSS, followed by one week where the school day incorporated morning instruction and afternoon group work time. Projects culminated in presentations made to community members including: scientists at Cornerstone Research and Mound Laser, staff at the Boonshoft Museum, a school board, employees of Possum Creek Park, the Dayton Chinese Church, a Green Fair, an elementary school and a middle school. Presentations included the use of PowerPoint and display models, and encompassed explanations of energy audits, designs for a duck house, analysis of museum displays, creation of materials to encourage children to recycle, and the development of games to engage students at other schools in the topic of GCC, as well as promote interest in DRSS itself.

Information about the Global Climate Change project activities was gathered over the course of seven days to capture manifestations of three of the five "qualities" of DRSS: **Collaboration, Persistence,** and **Inquiry.** The five qualities were selected and defined by students and teachers together, and are intended to encompass the traits of DRSS students. A team of observers organized by Dr. Suzanne Franco of Wright State University (WSU) collected data during the five project workdays at DRSS the week of April 19, 2010. Following the completion of the project, the combined WSU team and PAST Foundation ethnographer conducted a series of three dialogues capturing the voices of the students and teachers. On May 13, 2010 students (totaling 17) participated in two dialogues conducted at DRSS by Dr. Nimisha Patel of WSU. Dr. Patel of WSU conducted a third dialogue on May 14, 2010 for the five DRSS teachers.

Collaboration, Persistence & Inquiry are defined by the students and teachers as important traits that should be present in all projects.

Maria Cohen, the PAST Foundation ethnographer, joined the WSU team to observe the student teams in action during one of the project workdays, in addition to recording and evaluating the data collected from all three dialogues. The following sections delineate the qualities of ***Collaboration***, ***Persistence*** and ***Inquiry*** manifested at DRSS through the Global Climate Change projects, and are based on the guided conversations between participants and facilitators during the dialogues.

II. Project Workday Observations

Students and faculty members from Wright State University (WSU) observed Dayton Regional STEM School (DRSS) students during three of the final four days of their spring project development on *Global Climate Change* (GCC). Groups were observed for eleven (11) specific quantifiable behaviors one hour on each of the three days in order to capture the longitudinal processes of the project development. The observers, drawn from WSU and local educational institutions, varied across the three days, but the behavioral observations listed on the tally sheet did not. The tally sheet (Appendix A) was utilized to record the activities of both the teachers and the students. The number of groups observed depended on the number of observers available and the number of groups working on their projects. Typically, each observer focused on 2-3 groups. PAST and WSU researchers developed the tally sheet collaboratively. The purpose was to provide observers a form on which to record frequencies of behaviors that demonstrated the qualities being studied: ***Collaboration, Persistence*** and ***Inquiry***. The collaborative nature of the development enabled both qualitative and quantitative perspectives to be imbued in the observations. As noted in the introduction the three qualities under investigation are part of the five [5} habits identified as integral to good education at the Dayton Regional STEM School and primary in the success of project-based learning. Prior to the opening of the school, DRSS faculty and administration developed definitions of these three qualities and have published them at the entrance to the school. Additional refinements to the tally sheet were added after discussion with STEM high school teachers about possible manifestations of these three qualities during the project implementation in May.

During each of the three days of observations, students attended structured classes in the mornings; they worked on their projects after lunch. Thus, all observations took place during the afternoon. Each observer reviewed the tally sheet with the site manager and was directed to a specific group(s) for observation. After one hour of observations, observers submitted their tally sheet; if needed, they were directed to another group to observe. The observations were non-participatory and students and teachers were informed that the observers would not be conversing with groups during their time with the group.

II A. Observations: Collaboration and Inquiry

Table 1: Frequency Counts for Observed Behaviors, Days 1-3 for All Groups presents the eleven behaviors observed within groups on each of the three days of observation. The letter 'T' preceding a behavior indicates a behavior observed of a teacher, while an “S” indicates a behavior observed of a student. The group numbers are random representing the number of groups observed each day, not a specific group (N=18, Day 1; N=15, Day 2; and N=9, Day 3). The eleven observed behaviors are also visually represented in (Appendix B; Figures 1-11). Only two groups, randomly assigned as

TABLE 1: FREQUENCY COUNTS FOR OBSERVED BEHAVIORS, DAYS 1-3 FOR ALL GROUPS

Type of Behavior		Number of Groups Observed																		
Question 1		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTALS
T-Interacts with students by asking questions of designs, demonstration and prediction	Day 1	2		0	1	0	1	0	2	2	3	2	7	13	0	1	9	0	1	42
	Day 2	9	6	9	15	11	0	13	5	3	0	10	22	12	0	19				134
	Day 3	8	4	3	9	13	9	12	0	10										68
																				244
Question 2		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
T-any declarative statement is followed immediately by a question to make the student think, consider and expound	Day 1	24	18	0	0	0	0	0	1	0	4	0	2	5	0	2	3	0	0	59
	Day 2	11	10	3	6	2	0	1	0	1	0	8	0	0	0	12				54
	Day 3	0	0	4	11	10	6	2	2	10										45
																				158
Question 3		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
T-Allow students time to synthesize, experiment, fail and consider alternatives	Day 1	0	0	0	3	0	1	0	2	0	6	0	0	4	0	2	3	0	0	21
	Day 2	6	3	4	4	0	0	1	0	0	0	0	4	6	0	5				33
	Day 3	8	5	2	5	14	2	1	1	8										46
																				100
Question 4		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S-Asking question among peers and team as well as Teacher	Day 1	23	39	2	9	28	5	2	1	14	9	11	23	24	16	16	17	48	32	319
	Day 2	25	6	13	6	14	14	12	9	9	0	21	3	20	0	28				180
	Day 3	1	3	4	5	26	14	3	40	17										113
																				612
Question 5		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S-Verifying understandings or conclusions with each other	Day 1	23	49	0	9	9	3	3	0	4	7	2	20	33	14	11	20	1	1	209
	Day 2	27	23	9	2	22	8	19	38	5	0	26	22	18	0	73				292
	Day 3	1	2	7	17	34	51	2	90	23										227
																				728
Question 6		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S-Documenting experimentation	Day 1	0	0	0	6	0	3	0	0	0	8	2	0	0	6	3	0	0	0	28
	Day 2	10	6	15	0	0	0	0	0	6	0	0	10	5	0	0				52
	Day 3	2	1	8	1	8	0	0	20	3										43
																				123
Question 7		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S-Willing to make multiple drafts of POL to achieve success	Day 1	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	6
	Day 2	2	0	1	0	0	0	0	22	0	0	0	0	0	0	0				25
	Day 3	6	3	0	2	13	0	0	33	6										63
																				94
Question 8		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S-Focused on the task at hand (either working individually or as a group)	Day 1	125	83	1	6	6	4	3	14	11	9	5	68	62	14	36	90	76	54	667
	Day 2	28	27	20	172	76	90	141	145	12	0	86	20	41	0	224				1082
	Day 3	28	19	12	11	20	36	128	39	23										316
																				2065
Question 9		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S-Using their hands	Day 1	89	68	0	3	5	5	1	0	0	4	7	31	18	5	5	16	37	16	310
	Day 2	6	0	10	51	59	0	98	16	6	0	14	8	48	0	160				476
	Day 3	16	10	0	0	3	16	2	86	48										181
																				967
Question 10		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S-Demonstrates compassion and honesty in interactions	Day 1	0	0	0	3	8	0	0	0	0	5	0	2	14	1	1	0	0	0	34
	Day 2	10	0	18	0	0	0	0	8	1	0	6	3	19	0	0				65
	Day 3	0	0	0	0	1	11	0	3	26										41
																				140
Question 11		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
S-Willing to compromise for good of group.	Day 1	0	1	0	6	2	1	0	0	0	7	0	5	7	1	2	0	0	0	32
	Day 2	5	0	3	0	0	0	0	11	0	0	14	0	12	0	0				45
	Day 3	0	0	0	0	0	7	0	21	27										55
																				132

Day 1 = 18 Groups Observed	Day 2 = 15 Groups Observed	Day 3 = 9 Groups Observed

Group A and *Group B,* were observed all three days by the same observers, and Figures 12-22 (Appendix C) represent the changes in behavior of these two groups over the course of the project.

Color-coding in yellow (Day1), green (Day2) and orange (Day3) remain consistent for Table 1 and for Figures 1-11, allowing for ease of comparison between days. Data reveal that many of the behaviors characterizing **persistence**, **collaboration**, and **inquiry** were not observed in all groups on the first day of observation. However, such behaviors were frequently observed during the third day of observations, supporting the fact that group behavior over the project development timeline changed as the projects neared completion.

The student behaviors most frequently observed over the three days were:

1. Q4: Asking questions among peers and team as well as teacher; and,
2. Q5: Verifying understandings or conclusions with each other.

On each of the three days, observers indicated that every group asked questions among themselves and of their teacher with the exception of two groups on Day 2 (Figure 4). Furthermore, on the first two days, all but two groups were observed verifying understandings or conclusions with each other (Figure 5); this behavior was observed by all of the groups on the third day. These behaviors represent both collaboration and inquiry.

Observers also noted that collaboration and inquiry could not be readily siloed when observing group interaction. Therefore, questions 1, 4, and 5 were compared over the course of the three days (Figures 23). The purpose of this analysis was to further explore the relationship between these behaviors to

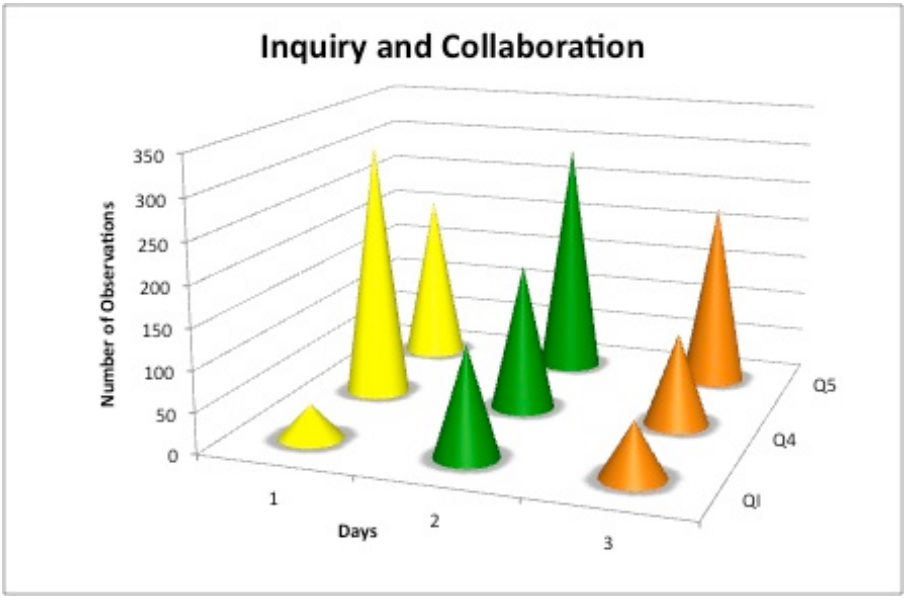


Figure 23. Inquiry and Collaboration comparison

determine if observers could detect when collaboration began to occur, and if there was a lag in one or the other facets being observed. The observers noted the following actions:

Q1: Note how many times Teacher [T] interacts with students by asking questions of designs, demonstration and prediction.
Q4: Note how many times Student [S] asks question among peers and team as well as Teacher.
Q5: Note how many times Student [S] verifies understandings or conclusions with each other.

The data presented in Figures 24-26 shows that students asked far more questions on Day 1 than on Day 3 (Figures 24-26). This supports the finding that collaboration behaviors decreased as the project neared completion. By Day 3, students were more involved with inquiry, as evidenced by the high number of verification behaviors observed (Figures 24-26) The incidences noted for teacher-asked questions (Figures 24-26) triples in frequency from Day 1 to Day 2, and goes back down during Day 3. This is evidence that the students became more involved in inquiry related behaviors as projects neared completion.

The three teacher behaviors observed reflected inquiry methods of instruction (Figures 1-3). On Day 1, approximately half of the groups had teachers who engaged in these methods (some of the groups had the same teacher). By the third day, all of the groups had teachers who engaged in these inquiry methods. Thus, as the projects were being finalized the teachers used inquiry methods more frequently in response to student questions.

II B. Persistence

Observations indicated that student persistence increased over the three-day period. One behavior reflecting this was focusing on the task, either as individuals or as a group (Figure 8). The frequency of this behavior increased significantly between day one and day two. Two other behaviors representing persistence also increased over the three days: documenting experimentation (Figure 6) and willingness to generate multiple drafts (Figure 7). These behaviors were observed in some of the groups during day one, and were observed in all but three groups on day three, while students were finalizing their projects

To further study the emergence of collaboration, persistence and inquiry, two groups are detailed in Figures 12-22. Both groups had unique observers complete the tally sheets during the three days of observation. More specifically, *Group A* had the same observer for three days; *Group B* had a different observer who completed the tally sheet for three days. The rationale for including this analysis was to remove any observation biases that may have been introduced by having different observers for groups each of

the three days. More specifically, it is possible that some observers interpreted behaviors differently than others. With the potential bias removed, the analysis was initiated to identify any trends related to the numbers of incidences of the three qualities over the three days.

For *Group B*, incidences of inquiry (Figures 12-16) and persistence (Figure 18) increased from Day 1 to Day 2. However, the Day 3 observation time was limited to 10 minutes instead of one hour due to the arrival of a guest speaker. The observer remarked that he recorded more inquiry activity in ten minutes during the 3rd day than he did during one hour on Day 3 for other groups. He predicted that if the group had not stopped when the guest speaker arrived, the final numbers of incidences of inquiry would have been far greater than during Day 2. Collaboration (Figures 20-22) decreased over the two days. The observer predicted that the number of incidences for collaboration would have been a low number.

The same trends can be seen from Day 1 to Day 3 for *Group A*. Inquiry incidences increased over the three days (Figures 12-16). Persistence increased in one area (Figure 18), but had no change for the other behaviors associated with persistence (Figures 17 and 19). Collaboration incidences decreased by Day 3 (Figures 20, 21, and 22). There were no anomalies during the observations for this group.

These findings support the belief that there is a lag in the emergence and focus of inquiry-related behaviors for both teachers and students.

II C. Compassion and Compromise

The final two observations of the set of eleven behaviors represent exact vocabulary taken from the DRSS definitions of **collaboration**, **inquiry** and **persistence**.

> Q10: Student [S] demonstrates compassion and honesty in interactions.
> Q11: Student [S] willing to compromise for good of group.

Although the terms "compassion" and "compromise" vary in meaning across age, ethnicity and economic status, none of the observers asked to have the terms further defined. In analysis of the data we noted the sharp increase in the two behaviors on Day 3 (Figures 10 and 11). The question arose, did this rise represent the acclimation of the observers, or the rise in the behavior. Since the observers on Day 3 were predominantly new observers, we determined that the increase represents an increase in the two behaviors among students. At the end of the project, the teams were working against the deadline to finish their presentations, and the drive to finish seems to have stimulated more acts of compassion and more compromise.

III. Ethnographic Dialogue Observations

The following sections are organized by each DRSS quality captured, beginning with the exploration of **collaboration**, which was the most fully explored of the three during the student and teacher dialogues, particularly in terms of teacher modeling of DRSS qualities. **Persistence** and **inquiry** were in evidence in comments made by teachers and students as well, though inquiry was not as overtly discussed as was collaboration and persistence. These explorations incorporate descriptions of teacher behavior and student behavior as described by both teachers and students. Each subsection is divided by examples of the qualities exhibited during the GCC projects, followed by examples of setbacks, if any, in that particular subset, followed by reflections of teachers and students on ways to better enhance collaboration, persistence and inquiry at DRSS in future projects. Perspectives of teachers gathered during the teacher dialogue are indicated by "t" followed by a number, e.g. "t31"; perspectives of students are indicated by "s" followed by a number, e.g. "s121". There are numerous examples below where perspectives are shared by teachers and students.

III A. Collaboration

DRSS definition of Collaboration*: Student works independently and as contributing members of a team, accepting and reacting to improve oneself based on feedback and critique, and demonstrates compassion and honesty in all interactions with others.*

This section presents statements by teachers and by students that reflect ideas about ways in which collaboration occurred and include three subthemes: Project Design, Project Structure, and Group Dynamics

Collaboration among the teachers at DRSS was strongly in evidence, especially where teachers worked together to design the GCC projects, and to provide feedback for student presentations. Teachers indicated that **collaboration** among themselves was a "real strength of the project" and a "true integration" of their individual strengths (t10). Teachers also noted that future projects would benefit from increased attention to consistency, coordination, communication and time.

Teachers noted that future projects would benefit from increased attention to consistency, coordination, communication and time.

<u>During the GCC projects</u>:

- Teachers consulted each other when outside their content area comfort zone (t10, t25)
- Teachers worked with students in all of the groups during class time (t48)

- Teachers worked with people outside of DRSS (t23, t40, t43)

Setbacks:

- Groups assigned to non-educator coaches who were "outside their comfort zone" and in "over their heads" were not as productive as those assigned to teacher-coaches (t31, t43)

For future projects:

- Teachers develop all projects before they are assigned to non-educator coaches to ensure projects have clear guidelines, and entail enough activities and challenges for the students to span the allotted time frame (t29, t30, t32)
    - Non-educator coaches receive adequate training in content areas and clear guidelines in how to work with DRSS student groups (t43)
- Teachers communicate more effectively to coordinate incentives and break time to promote perception of equality among students (t50, t51, t52, t53)
- Teachers receive adequate time to carry project to completion, including time for all groups to share their projects with the entire school (t44, t45)
- Explore the possibility of organizing teams by advisory groups with advisory-selected projects, "following the philosophy of our school" (t43)

Collaboration among students was strongest where effective project design initiated engagement, was structured to provide a flexible framework, and attention was paid to fostering positive group dynamics. DRSS students worked together successfully to create presentations, PowerPoints, audits, building designs, and activities for children in classrooms and at the Green Fair.

Project Design initiated engagement and provided numerous options, giving students a sense of freedom of choice when possible.

During the GCC projects:

- Most projects were designed to foster collaboration (t11, s1)
- Students went out to the community (t3, s10, s11)
- Teachers began working with student groups during content stage of project (t1, t13)
- Students began to work with each other during content stage of project (t1, t14, s39)
- Teachers modeled collaboration (t10, t25)
- Project was expandable, so students could divide work equitably (t24, s6, s39, s60, s131)

Setbacks:

- Students who were done early distracted those groups still working (t29, t30)
- Students in groups who got their last choice of projects felt forced, group did not "jell" (t35)
- Some groups were too large for effective collaboration, not everyone had enough

to do (t30, s138)
- Some projects were not designed to spur collaboration (s136)
- Non-educator coaches were ineffectual (s178, s179)

For future projects:
- Students are given a degree of choice and input, as well as a wide range of projects from which to choose (t5, t35, t37, t40, t49)
- Students have a clear goal at the outset of the project (t25, t26)
- Project involves enough tasks for students to divide equally for the duration of the work time (t20, t21, t23, t24, t29, t30)
- More consistency in community building activities across the student body (t29, t52, t53, s182, s183, s184)

Project Structure provided student groups with a flexible framework on which to build their projects individually and as a team.

During the GCC project:
- Structured work time set up students for collaboration (t1, t23, t47, t48, s66, s89)
- Teachers worked with students to help them recognize each other's strengths, and capitalize on those strengths (t24, t46, t47, t49)
- Teachers provided ongoing supervision so students "knew what they were doing" (s134)
- Teachers provided fluid guidelines and templates, leaving structure with enough room for student creativity (t4, t22, t23, t46, s34, s39, s135)
    - Students decided as a group to deviate from the templates (t49, s60)
- Students felt they had freedom to work how they wanted to (s39, s45, s46, s49, s94, s104, s186)
- Some coaches were "cool" and treated students like adults, let them "hang out" (s87, s123, s128)
    - Coaches took students out to eat (s93, s101, s173)
- Students engaged in community building by sharing food (s12, s23)

Setbacks:
- Students were angered by inconsistencies in food sharing activities (s182, s183, s184)
- Groups were frustrated by lack of guidance from teacher (t18, s125)
- Students were working individually without planning or discussion (t18, t25, t26, s133, s167)

For future projects:
- Teachers provide structure and guidance on how to work together and how to share information (t18, t28)

Group Dynamics, if not attended to, can derail collaboration. Group dynamics described below sustained collaboration among students for the duration of their

projects.

<u>During the GCC project:</u>

- Group members took direction well and were well-prepared (s58, s70, s131, s132, s172)
- Students perceived equality among group members (s131, s160, s162, s164, s168, s170)
    - Group was right size to divide work (t20, s110)
- There were no arguments (s1, s50, s59)
    - When arguments broke out, people were transferred to other groups (s42)
    - Students worked together well (s55, s56, s170)
    - Group members liked each other and got along well (s107, s108, s131)
    - Members of the group shared the same viewpoint on Global Climate Change (s172)
- Students felt confident and comfortable with their roles within the group (t24, s170)
- Constructive criticism was acted on by group member (s141)
- Students were given the opportunity to work with people they don't normally work with (s174)
- Group members were compliant, with everyone taking responsibility for doing their tasks
    - Non-contributors inspired collaboration in the rest of the group (s49, s52)
    - Group members devised and carried out strategies to deal with non-contributors (s137, s139)

Collaboration among students was strongest where effective project design initiated engagement and provided a flexible framework within positive group dynamics.

<u>Setbacks:</u>

- In some groups there was a perception of inequality among group members
    - Some students worked individually (t21, s48, s51, s106)
    - Group members were frustrated by "slackers" (s53, s133, s137, s143, s144, s145, s146, s161)
- Some groups were too large, and there was not enough work (s109, s138)

<u>For future projects:</u>

- A healthy balance between friends and non-friends (t37)
- Thoughtful placement of IEP students (t19, t21)
- Members perceive they have a choice of projects (t35)
- Group size is small enough to give everyone opportunities to participate (s109, s138)

III B. PERSISTENCE

DRSS definition of Persistence: ***Student sustains a problem solving process over time while remaining focused and producing multiple drafts, much as a skilled artisan, to achieve success.***

This section presents statements by teachers and by students that reflect ways in which persistence occurred and include three subthemes: Project Design, Project Structure, and Group Dynamics

Teachers modeled **persistence** as they guided their students through the GCC project toward their culminating presentations of learning, devising and employing strategies to motivate students as needed (t46, t47). Student groups, on the whole, did a good job of presenting themselves to the public (t22, t23). Groups overcame numerous challenges, including setbacks in collaboration, boredom, and at times a lack of inquiry, but as their teachers would say "they pulled it off" (t21, t23, t39) when it came time to present.

Persistence in students was fostered by good project design, which included incorporating incentives to encourage a high level of student focus and involvement. The GCC unit was designed and structured with an adequate time frame allowing for multiple presentations, feedback and revisions. Group dynamics came into play as well, where students persevered despite being in a "bad group" (s106).

Project Design provided the student with a clearly defined culminating event, with incentives to motivate and sustain student engagement.

<u>During the GCC project:</u>

- Project had a clear goal (t26, t27, s61)
    - Students understood what they needed to do to reach that goal (t22, t23, t47, s134, s135)
    - Students had choice of projects, and variety within those projects (t2, t5)
    - Most goals were actualized (s69)
- Students applied techniques and strategies learned throughout the school year (t8, t12)
- Design incorporated elements inspiring participation
    - Going outside of school (s10, s22, s88, s90)
    - Working with different people (s11, s174)
    - Working with friends (s18, s20, s21)
    - Creating activities to do with children (s7, s14, s60)
    - Doing hands-on work (s15, s130)
    - Working with technology (s95)
    - Making an impact
        - On energy usage (s69)
        - Teaching children about recycling (s14)
- Teachers added other incentives including breaks, food sharing, and going out to

eat (t50, s12, s91, s93, s101, s173)
- Teachers provided adequate supervision, with a balance where students are kept on track, yet perceive freedom to work when and where they like (t46, s94, s103, s104, s123, s128)

Setbacks:
- Some goals were not actualized, and students lost momentum (t42, t44, s59, s65, s74, s111, s130, s157)
- Projects did not have a clearly defined goal (s67, s74, s75)
- Students did not perceive choice in project assignments (s114, s116)
- Students who were finished with work distracted those still working (t29, t42)
- Students were faced with performance anxiety, and worried that presentation would be too unsophisticated for the intended audience of professionals and experts (s66, s72, s83, s153, s155, s158)

For future projects:
- Projects are described clearly at the outset
    - Changes in design midway are clearly defined with appropriate guidelines
- Groups are given projects large enough to divide among members; complex enough to require all the time allotted; and interesting enough to engage students throughout the course of the project (t29, t30)
- Goal is contained, so students remain focused (t26)
- Structure project presentations so they happened at the same time (t42)

Project Structure provided a progression of activities, guiding students through the process of creating a presentation of learning.

During the GCC project:
- Teachers provided framework with daily goals (t23, s67, s134)
    - Students took their own initiative with daily goals (t22, t23)
- Students in group "focused on doing the work" (s59)
    - Students did research (s71)
- Groups engaged in multiple practice presentations to a variety of audiences and revised presentations based on feedback (t22, t23, t25, t48, t51, s43, s45, s56, s58, s67, s168, s169, s170)
- Students created multiple prototypes and models (s106)
- Students persevered with project work despite perceived inequities and lack of guidance (t18, t21, t29, t39, s50, s125, s126, s145)
- Students coped with changes in project design and/or goal midway through (s49, s79, s85)

The creation of multiple prototypes and presentations with a focus on revising and reevaluating fostered persistence among students.

- Students worked to completion despite lack of interest and/or choice in project (t39)

Setbacks:

- Inconsistencies in work conditions disrupted student focus and decreased motivation (t51, t52, t53, s44)
- Inconsistencies with incentives provided by coaches fostered sense of apathy and injustice (s178, s183, s184, s185)
- Separation of student groups was enforced, instilling sense of captivity and decreasing motivation and focus (t29, s43, s44, s47, s50, s55, s56, s105, s122, s124, s126, s127, s180, s187, s188, s189)
- Some students were hampered by a lack of guidance (s125, s178, s179)
- Some students were frustrated by having to adhere to rigid guidelines (s153)

For the future:

- Students are provided with consistent and equitable incentives (t51, t52, t53)
    - Food sharing at school
    - Going off campus to eat
    - Field trips
    - Breaks and opportunities to socialize
    - Independence

Group Dynamics, when off-kilter, provides a backdrop for persistence in students. Persistence was evident among students where collaboration was lacking. Given that skewed group dynamics are in themselves setbacks, the following only addresses occurrences during the project.

During the GCC project:

- Students continued to work when others in the group were perceived to be "slacking off" (s42, s48, s49, s106, s143, s145, s146)
- Where a student had difficulty focusing on the project, other students felt this threw the group off stride, but they "pulled it off" (t21, s49)
- Groups where students were working individually or could not agree on project ideas pulled together over course of project (t25, s53)

III C. INQUIRY

DRSS definition of Inquiry: ***Student is inquisitive, not only asking questions, but acting upon those questions in an effort to discover the answers, accepting confusion, uncertainty and the risk of failure as part of the process.***

Teachers demonstrated **inquiry** while researching GCC projects (t33, t43), and by their choice of the controversial topic of Global Climate Change in the project design in and of itself spurred **inquiry** in DRSS students. Within the teacher and student dialogues, the

quality of **inquiry** was implied from descriptions of student engagement in the content area classes, learning to present, as well as the "brainstorming" activities done by project teams. **Inquiry** was activated in the earliest stage of the projects, during content area instruction, and continued through project development and beyond presentations of learning, when students participated in post-project reflections.

<u>During the GCC project:</u>

- Content area curriculum "fueled conversation" (t8, t16, t17)
    - Students were given both sides of a controversial subject and "opportunity to see, argue and analyze both perspectives" (t7, s26, s27, s28, s96, s97, s166)
    - Students immediately "engaged one another…with conviction" in the topic and began discussing GCC across the curriculum (t7, t8, t14)
    - Students engaged in debate in-class, during lunch and between classes (t15, s120)
    - Confusion generated by classmate debates was accepted (t14, t15, s166)
- Brainstorming activities began before project work was formally initiated (t13, t15)
- Cross-curricular ties were made overt (t6, s99)
    - Students questioned cross-curricular elements (s86, s100)
- Students worked beyond elements suggested by teachers (s60)
    - Students took their own initiative (t22)
- Students accepted uncertainty generated by mid-project changes (s49, s79)
- Students engaged in hands-on activities (s15)
- Students learned "all aspects of GCC, data, analyzing, and how to present," in addition to conducting research and using tools (t9, s25, s26, s45, s71, s95, s102, s133)
    - Students "questioned themselves" after class feedback (t48)
- Students reflected in-class on project possibilities and short-comings (t40, s64, s165)
    - Project design or structure was questioned (s62, s67, s129, s153)

Brainstorming and debate engaged students and helped them understand the need for mid-project changes to their designs.

<u>Setbacks:</u>

- Some students had little or no interest in the projects they were assigned and did not engage (t35, s25)
- Students had little or no interest in GCC as a topic (s119, s190)
- Some students were irritated by the level of debate and "shut down" (s28, s120, s166)
- Some students were unable to make cross-curricular connections
    - Students could not connect project to GCC (s33, s57, s84)
- Some students thought the project "pointless" because they were not receiving

grades (s147, s1490, s150)
- Inquiry was stifled by presence of outside group during energy audit (s65)

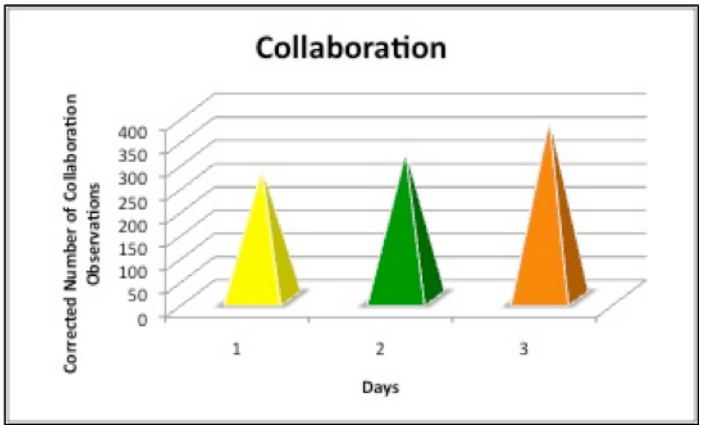
<u>For the future:</u>
- Provide a clear explanation of the purpose of Service Learning
- Continue to offer a degree of choice to students, as involvement in choice promotes engagement
    - Providing or inspiring a multitude of different activities within each project (t24)
    - Incorporating activities that employ students' individual talents and acknowledge individual limitations (t19, t24)

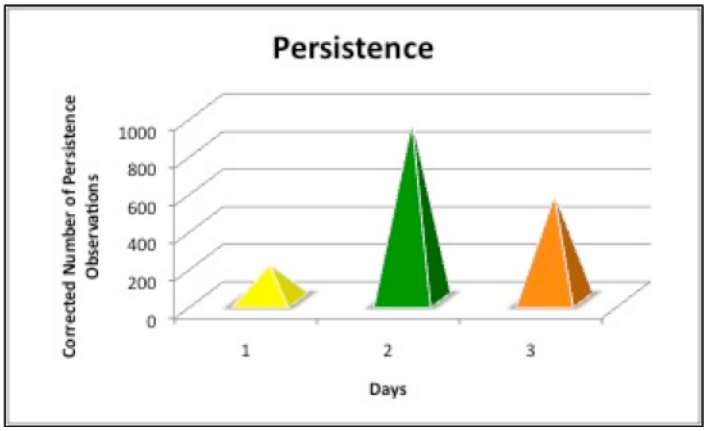
IV. Conclusions & Post Brainstorm for Future Research

IV A. Quantitative Observations Conclusions

The quantified analysis of the three days of observations provided important insight into the pace and presence of inquiry, collaboration and persistence. Students and Teachers exhibited all three qualities as well as compromise and compassion over the course of the project. The observers were able to capture this information on the tally sheets and provide valuable data that reflects when each of these qualities reached its greatest potential within the team dynamic. For example, in the early part of the project students asked fewer questions (Figure 24) but as the project proceeded they began to ask more questions and collaborate more reaching the height of collaboration day 3 (Figure 25) as the projects and presentation preparation drew to a close. Persistence like inquiry and collaboration also grew with the student's engagement in the project (Figure 26).

In some instances such as the division of inquiry and collaboration, observers found it almost impossible to separate the two informing us that we had to take a different tact in analyzing specific traits such as inquiry and collaboration. In the case of teamwork it becomes necessary to analyze the when collaboration and inquiry occur. Future studies of individuals that work separately on projects would provide an excellent comparison for gauging if inquiry occurs





Figures 24-26. These three graphs represent modified numbers so that all days can be compared equally.

sooner or later when students work collaboratively.

The information regarding behavior of teams in project based learning also is important for future planning and implementation of projects helping teachers structure the process to amplify these qualities among the team as well as skillfully precipitate specific qualities that need to occur as quickly as possible under the schedule of a project timeline.

IV B. Ethnographic Dialogue Conclusions

Analysis of the teacher and student dialogues demonstrates that the targeted qualities of Collaboration, Persistence and Inquiry were profusely in evidence through out the course of the Global Climate Change unit.

Teachers modeled collaborative behavior; offered projects designed to foster collaboration; and provided structure and guidance to facilitate collaboration. Students did work independently and as contributing members of their teams, particularly where there were positive group dynamics. There are indications that students reacted positively and appropriately to feedback and critique, as well as demonstrating compassion and honesty in their interactions with others.

All students demonstrated degrees of persistence, sustaining a problem solving process over time while remaining focused; produced multiple drafts of their presentations of learning; and with the exception of a few groups that had not presented at the time of this research, most all of the students successfully completed their culminating projects.

Close examination of student process provides confirmation that many students were intellectually engaged in the Global Climate Change unit, implying that students were inquisitive: asking questions and acting upon those questions to discover answers. Students accepted the confusion and uncertainty generated by a controversial subject, and accepted the risk of failure as part of the process.

IV C. Quantitative and Qualitative Nexus of the DRSS Knowledge Capture Study

In this brief review of the two studies, we find validation that what was observed in the quantitative study, was also perceived by students and teachers who clearly articulated a range of perspectives on the key themes captured by the ethnographic study. The quantitative analysis of observed behaviors of students and teachers during the GCC Project, followed by reflective discussion of their experience of the Project with both students and teachers, provides the opportunity to gain insight on the important outcomes of the project in ways that can also inform future project design and

implementation strategies. Focus on three DRSS student attributes – collaboration, persistence and inquiry - also links this study of classroom instruction and learning with the underlying philosophy and long-term goals of the school itself. While this study offers a snap-shot of a single project, the information gained can help to increase understanding of effective, new formal teaching and learning approaches that can help to foster these attributes in students, and can also contribute to development of integrated, hands-on learning experiences that are essential to STEM education.

We learned from the quantitative study that more *collaboration* was observed in the early stages of the GCC project, and that over time students shifted in their activities toward *inquiry* and *persistence* as projects reached completion. Teachers and students both shared the view that collaboration was an early strength of the GCC Project. Teachers commented that interaction among teachers during the planning and design phase of the Project was strengthened through a collaborative approach, and was also evident during content instruction prior to group project activities, when teachers noted that they worked together to assist each other with instruction outside of their "comfort zone." Teachers and students shared in their views that students were also eager to engage in discussion and debate on GCC issues, exploring controversial aspects, and linking issues in a cross-curricular context during the content instruction phase of the project. Students felt that the project structure and guidance of the teacher in developing a team approach were also essential to successful collaboration, inspired by teachers who modeled behaviors (e.g., co-teaching) that students could also explore. Students also felt that teachers who could effectively help students to see the strengths of others in creating their team project, also helped to structure the early stages of the project in ways that offered students the opportunity to collaborate to contribute and engage fully in the project.

Drawbacks noted by students concerned inconsistency of incentives across the groups, that contributed to a loss of motivation for some, leading to students who were considered "slackers" in their lack of engagement with the team. Teachers also sensed the range of incentives that emerged during the project (e.g., food sharing, going out to eat, meeting people in the community) contributed to underlying feelings of inequity across groups that can be improved through better coordination and communication in the future. Teachers also noted that student projects must be structured in ways that will allow the project to grow through student creativity, to build team skills and also assure that all students can fully participate and contribute to the project, with students also commenting that groups that were too large struggled to fully engage all students.

Where we see *persistence* increasing among the groups during the course of the GCC Project in the quantitative study, teachers and students also noted that persistence was more evident among groups where collaboration was lacking, suggesting that the link between those two activities is not only a function of time as a project nears completion, but can also be a function of the social construction of team relations. Students noted that frustration with "slackers" contributed to team strategies to overcome lack of engagement by some students to assure their project would be ready for presentation

by the end of the week. For some students, this also meant working individually to overcome perceived lack of structure or lack of guidance, in order to achieve project completion goals. For other students, freedom to work at their own pace to explore project options gave students an important incentive to work creatively to achieve project goals.

Additionally, students and teachers both noted the importance of the structure of the project in providing daily goals for students to focus on that helped to pace the project, with some students noting that students who completed work early were "distracting" to those who were still focused on project development. Project structure must also realistically provide guidance toward developing achievable project milestones, leading a few teachers to conclude that some students experienced loss of motivation when they failed to achieve all of their goals.

Both teachers and students felt that a range of factors contributed to successful project outcomes supported by *inquiry* leading to strategies for exploration and validation of project design. This included feedback from trial presentations as groups worked to project completion and final preparation for student presentations in the school and in the community. However, the perception by teachers as well as students that *inquiry* was more evident in early phases of the project extends the timeframe from the formal observation period of the quantitative study to encompass the earlier preparation phase during content instruction in which both teachers and students acknowledged the importance of the holistic GCC Project approach.

Teachers felt that the initial selection of the GCC topic would in itself require both teachers and students to engage in research activities, to explore ideas and participate actively in debate on controversial aspects of the issues. This provided students the opportunity to consider potential short-comings of a given view, to further analyze potential project directions prior to the actual team project process, as well as to experience a process of becoming informed on a new topic in preparation to inform others in their community including fellow students, younger students, and professionals and other adult experts in fields that relate to GCC issues. Students also shared in this view, noting the opportunity to learn about GCC issues, identifying relevant data to support their projects, analysis of data, and finally, how to present their project, all contributed to building a set of skills and tools to support the week-long GCC Project.

The connections between what was observed and what was experienced provide important insights that contribute to our ability to describe what has occurred informed by explanations of what occurred from first-hand knowledge and experience of the teachers and students who engaged in the GCC Project. In constructing these two studies we have learned not only about how this project was structured and implemented, but have also gained in our understanding of ways that can improve and strengthen future projects. These ideas are explored in the final section of this report.

IV D. Post Brainstorm for Future Research

One of the most powerful aspects of collaborative research is the ability to look objectively at the process and recommend future changes to it. This is especially true when collaborators from two different discplines are interested and excited about the nexus of data collected for the same project. In the DRSS study the processes of quantitative educational research and anthropological ethnographic methods are merged. These two processes exact different types of information but when combined have produced a rich reservoir of information and insight. Since this is the first time that the PAST anthropologists have worked with Wright State's educators we learned a lot and the following recommendations reflect genuine interest and commitment to seeing these types of interdisciplinary studies progress and build in the future.

Data Collection Recommendations:

1. A short podcast be given to all observers prior to the study outlining needs, goals and etiquette.
2. Observers be reminded daily by the research site manager each day that they are not to engage with the groups or teachers in any way. Observers are not participant/observers in this research
3. A timeframe be part of the observations. By observing behaviors every 1-2 minutes insures that the tally sheets are a good indicator of how often a behavior is observed.
4. Each team member wear a badge that indicates which team they belong to. This will allow observers to track the fluidity of teamwork over the course of the project, as well as inter and intra team dynamics
5. Future observations include what student behaviors are like outside of the project needs (eg. Students not engaged in project in common areas).

V. APPENDICES

A. Tally Sheet used by Observers
B. Figures 1-11 All Observations by question and day
C. Figures 12-22 Duck House and Energy Use Observations by question and day

V. Appendix A: Observation Tally Sheet

Group Name: Time of Observation: Where observed: Observer:

Activities to look for to document persistence, inquiry and collaboration
(What happens when should not look the same in each team or on separate days)

	Monday	Tuesday	Wednesday	Thursday	Friday
TEACHER					
1. **T** - interacts with students by asking questions of design, demonstration and prediction					
2. **T** - any declarative statement is followed immediately by a question to make the student think, consider and expound					
3. **T-** allow students time to synthesize, experiment, fail and consider alternatives					
STUDENT					
4. **S** - Asking question among peers and team as well as Teacher					
5. **S** - Verifying understandings or conclusions with each other					
6. **S** - Documenting experimentation					
7. **S** - Willing to make multiple drafts of POL to achieve success					
8. **S** - Focused on the task at hand (either working independently or as a group)					
9. **S** - Using their hands					
10. **S** - Demonstrates compassion and honesty in interactions					
11. **S** - Willing to compromise for good of group					

V. APPENDIX B: FIGURES 1-11

Figures 1-11 represent the unmodified observation numbers recorded each day over the course of three days (see Table 1). The days are consistently color-coded (Yellow = Day 1, Green = Day 2 and Orange = Day 3). Each figure is titled by the observation recorded and are presented in the same order as appears on the tally sheet and in the Table 1.

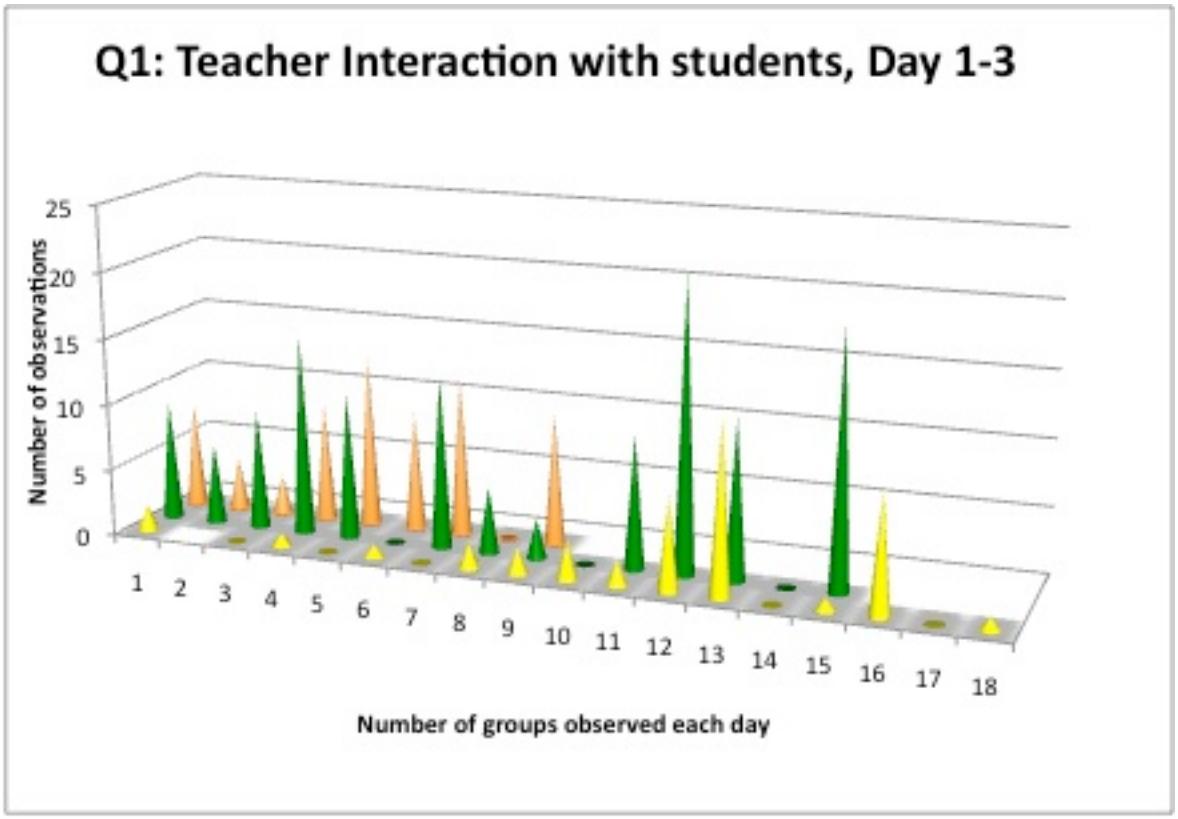


Figure 1. ***T-Interacts with students by asking questions of designs, demonstration and prediction***. Color-coded: Yellow = Day 1, Green = Day 2 and Orange = Day 3

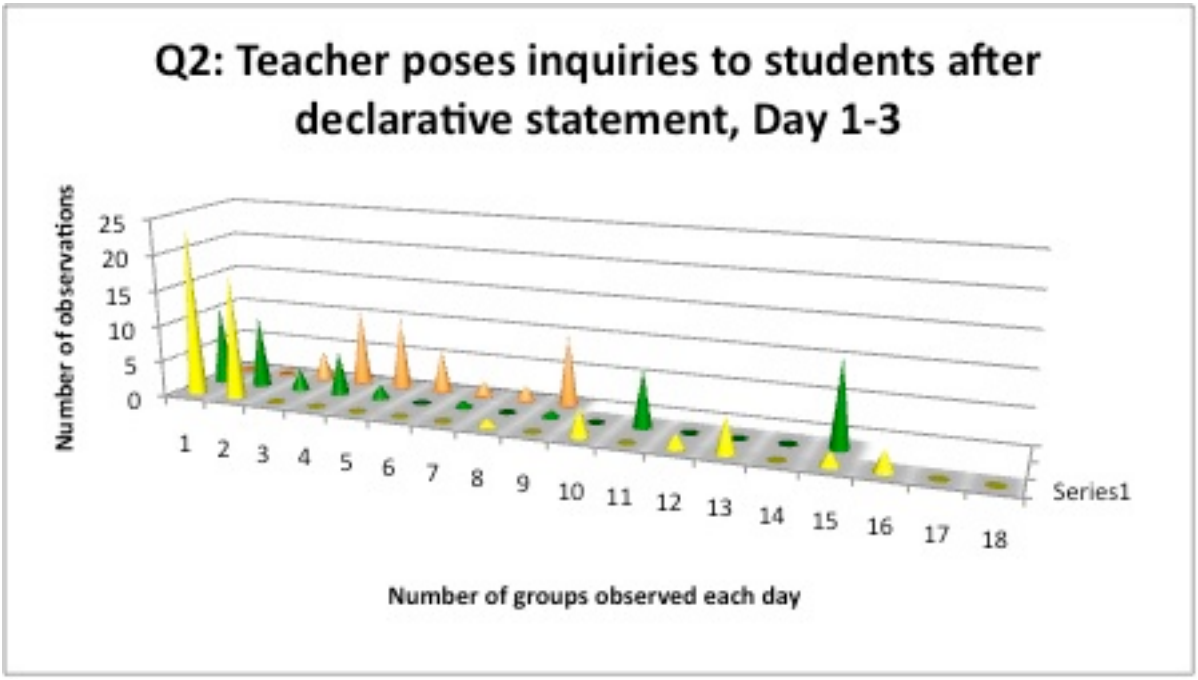


Figure 2. ***T-any declarative statement is followed immediately by a question to make the student think, consider and expound.*** Color-coded: Yellow = Day 1, Green = Day 2 and Orange = Day 3

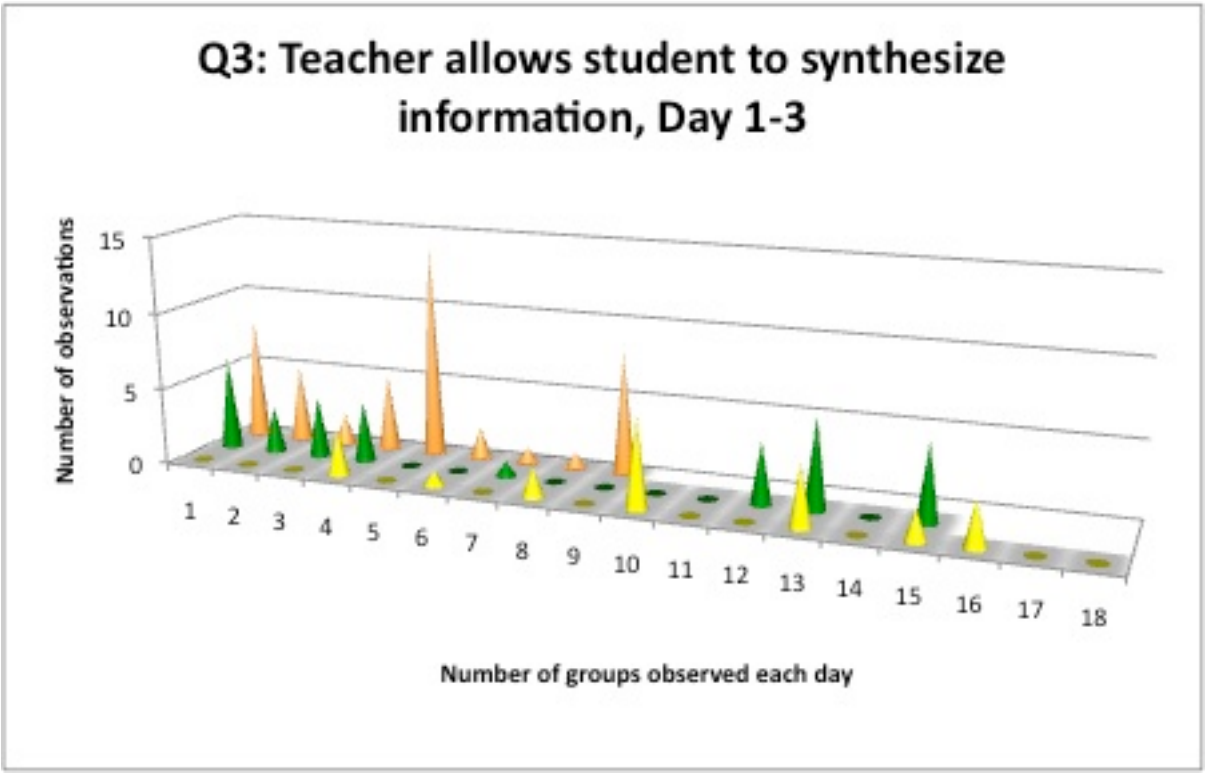


Figure 3. ***T-Allow students time to synthesize, experiment, fail and consider alternatives***

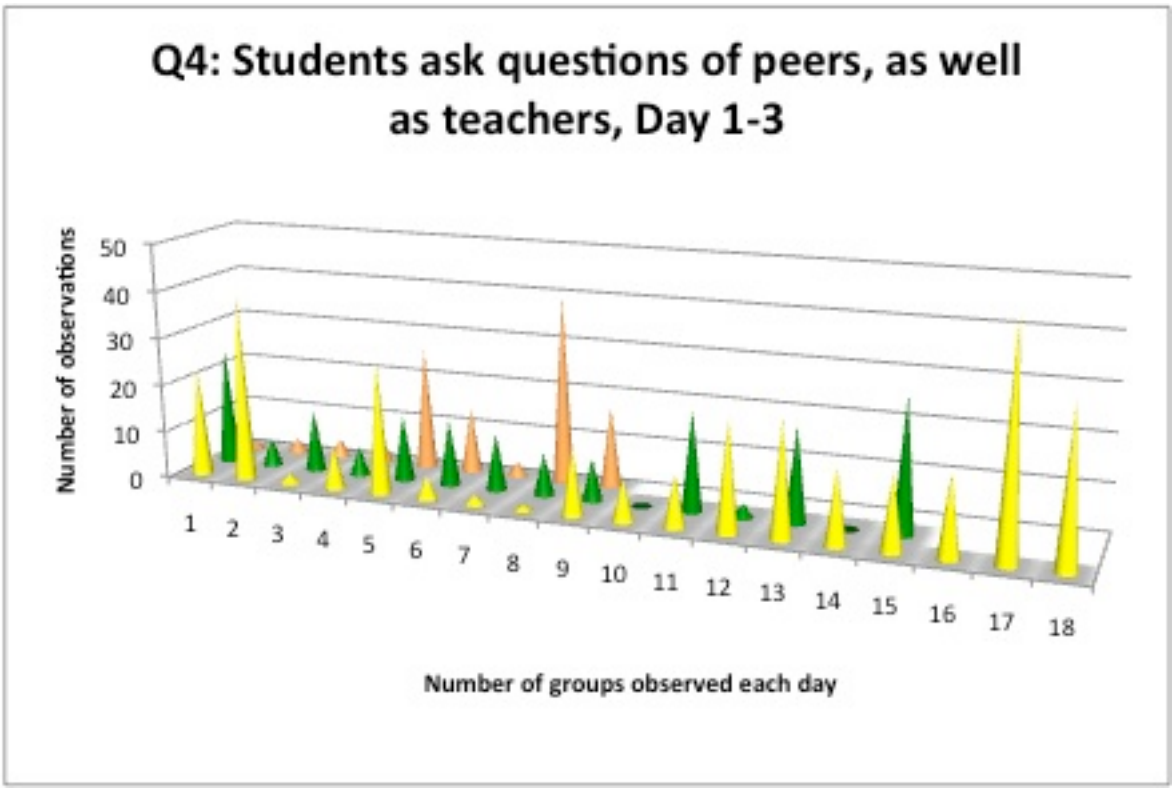


Figure 4. ***S-Asking question among peers and team as well as Teacher*** Color-coded: Yellow = Day 1, Green = Day 2 and Orange = Day 3

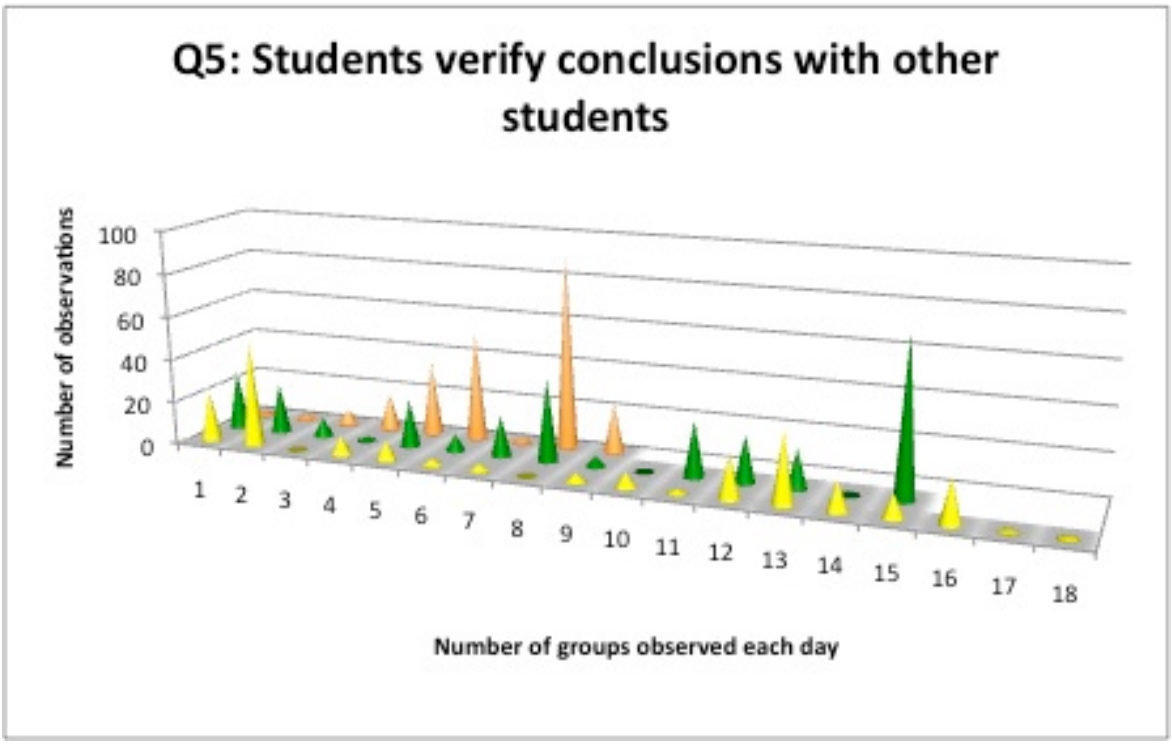


Figure 5. ***S-Verifying understandings or conclusions with each other***

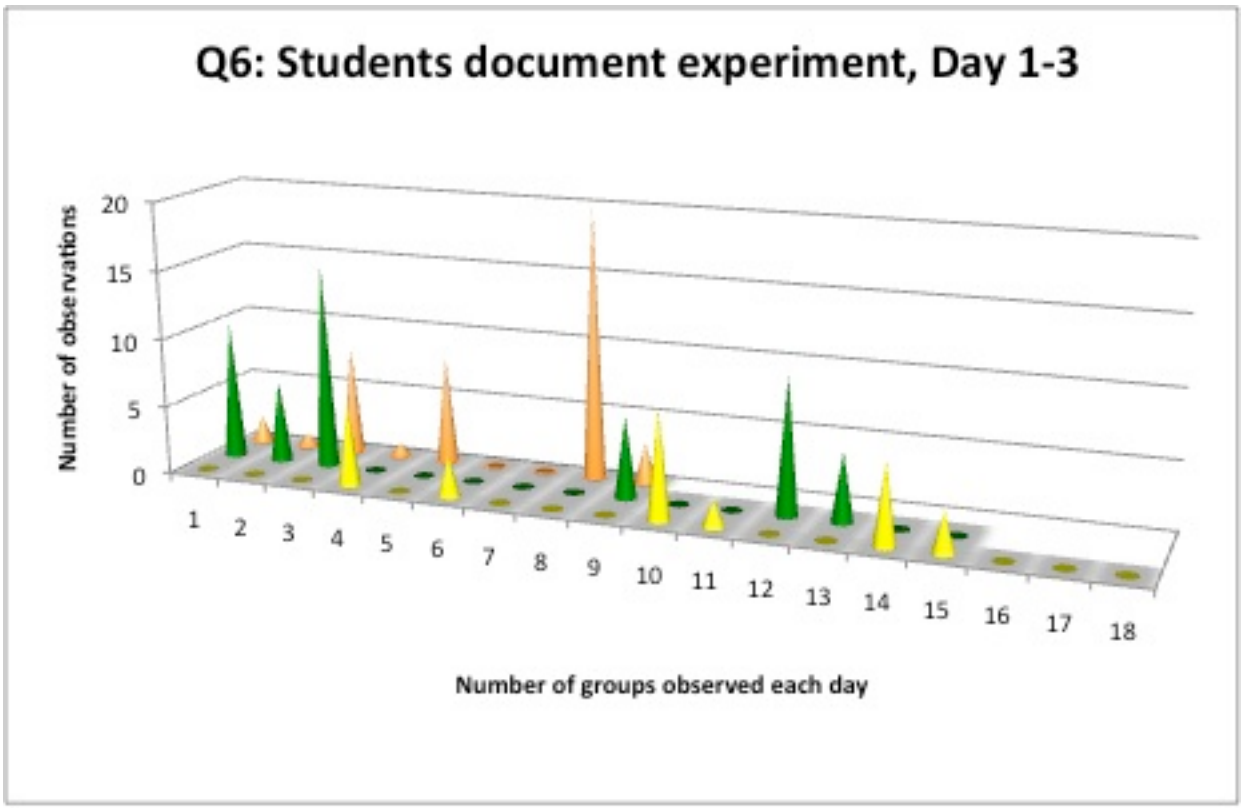


Figure 6. ***S-Documenting experimentation*** Color-coded: Yellow = Day 1, Green = Day 2 and Orange = Day 3

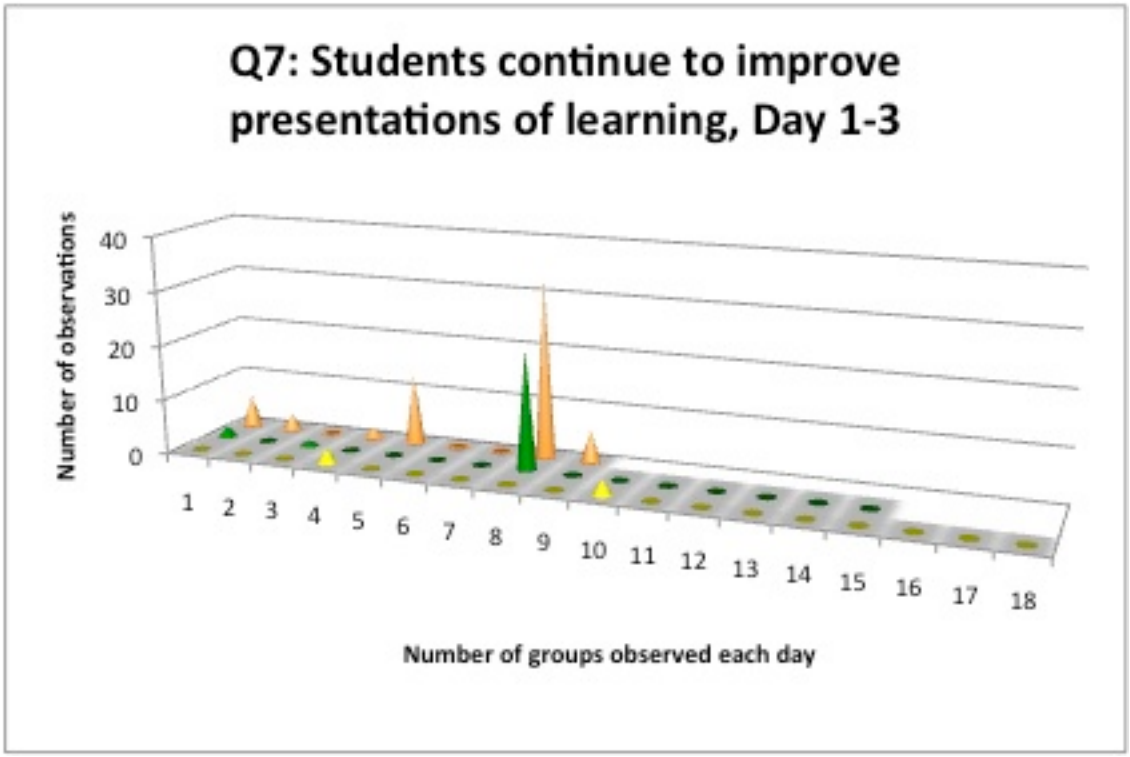


Figure 7. ***S-Willing to make multiple drafts of POL to achieve success***

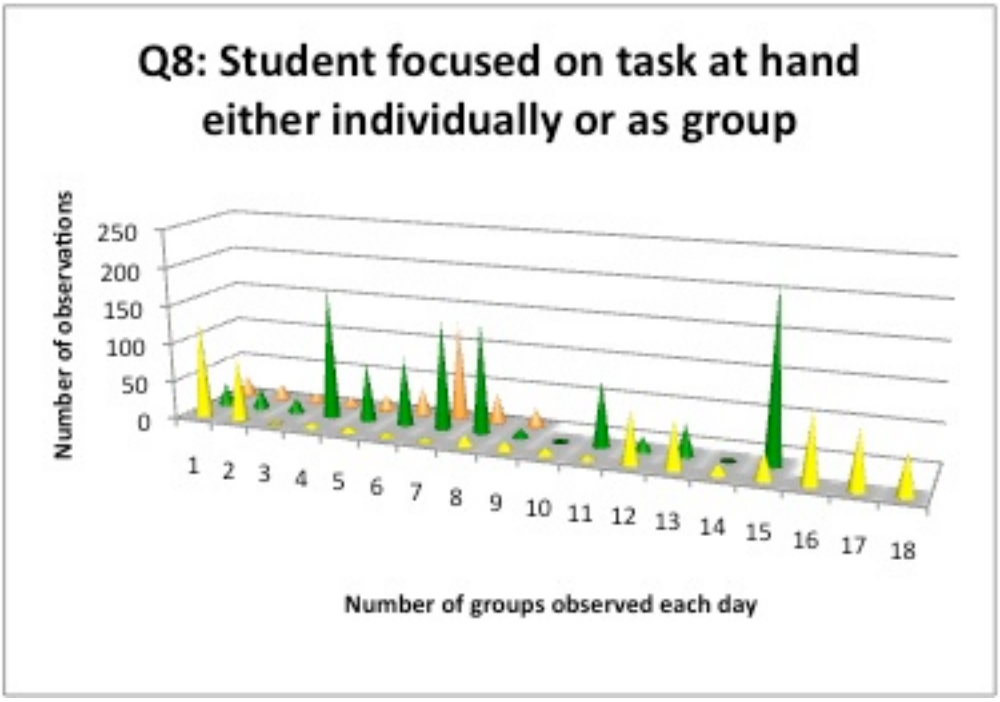


Figure 8. ***S-Focused on the task at hand (either working individually or as a group)*** Color-coded: Yellow = Day 1, Green = Day 2 and Orange = Day 3

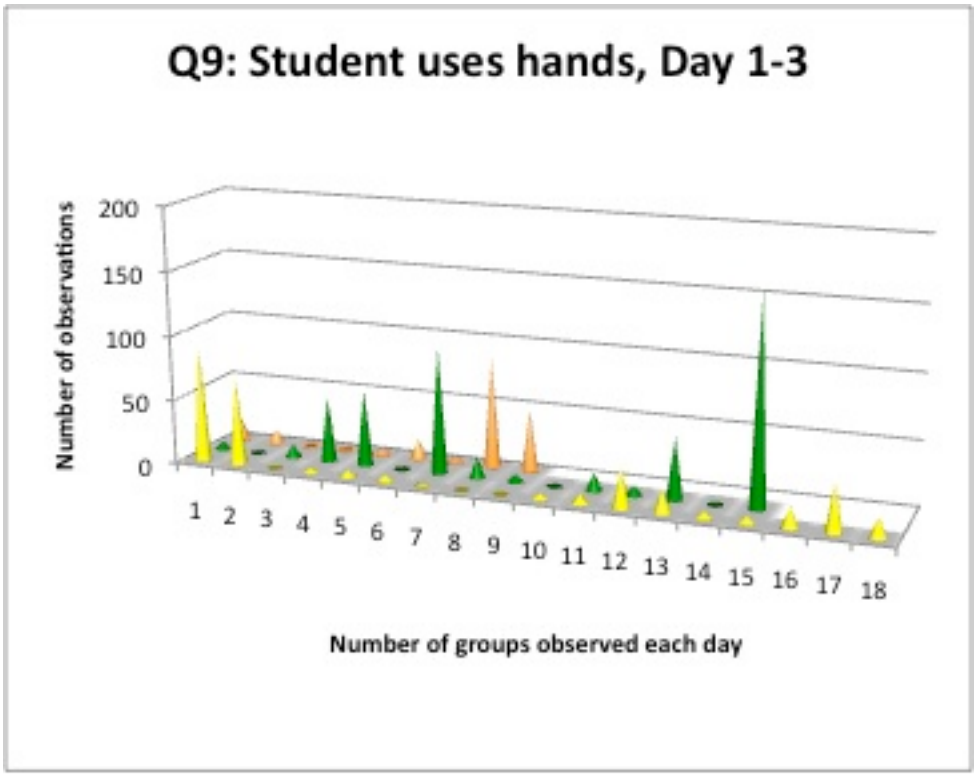


Figure 9. ***S-Using their hands***

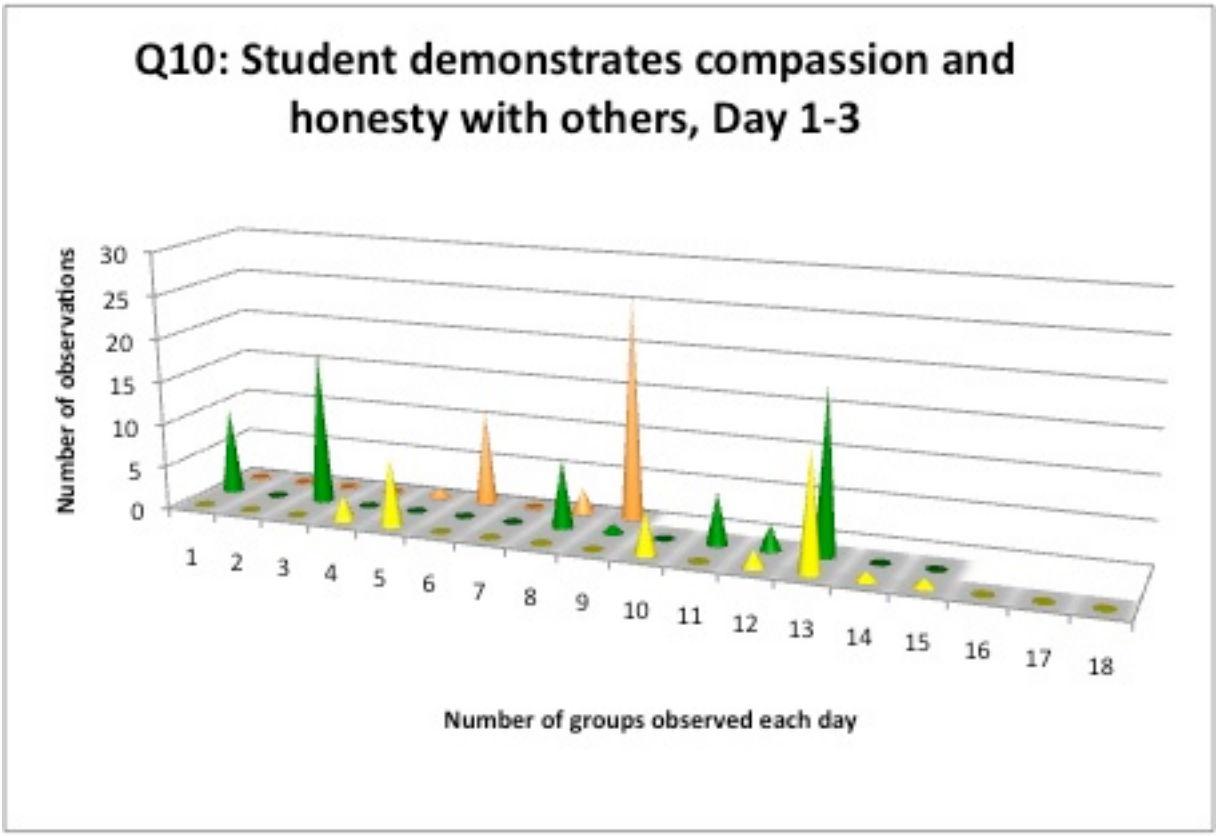


Figure 10. ***S-Demonstrates compassion and honesty in interactions*** Color-coded: Yellow = Day 1, Green = Day 2 and Orange = Day 3

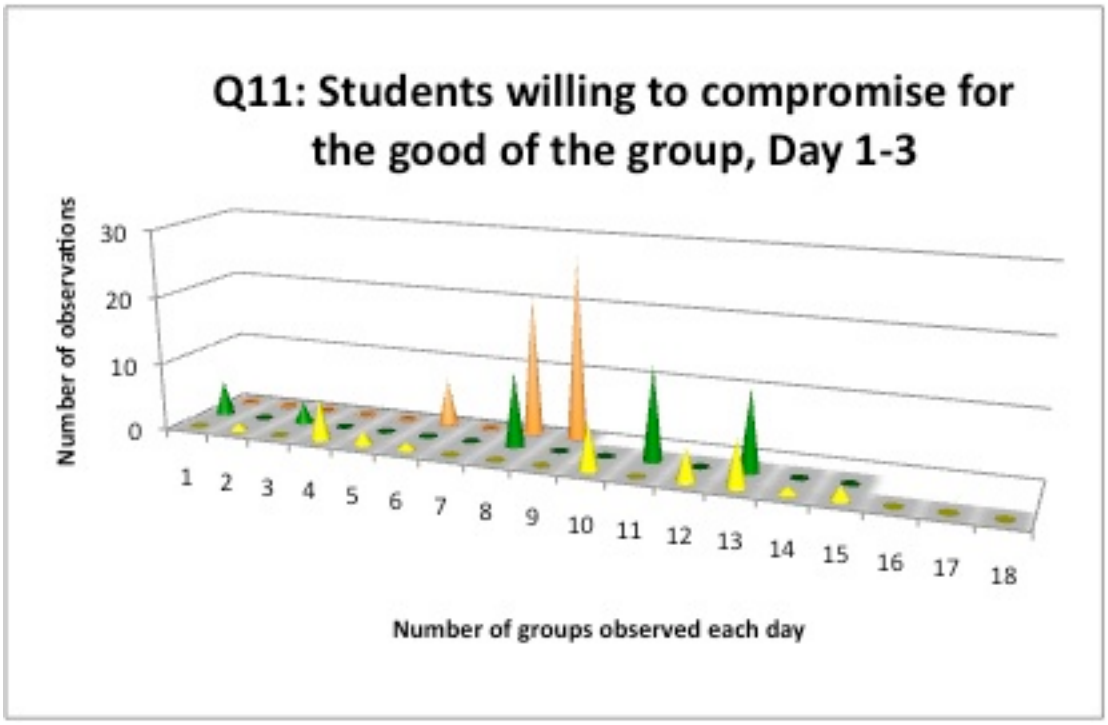


Figure 11. ***S-Willing to compromise for good of group***

V. APPENDIX C: FIGURES 12-22

Figures 12-22 represent two teams (Duck House and Energy Use) who were observed all three days by the same observers. The graphs are identical in presentation and order as Figures 1- 11 and reflect much the same conclusions. The importance of separating them out is to showcase the consistency of observation over time in comparison with the observations of all groups, which represent variations in observation and variation in observers.

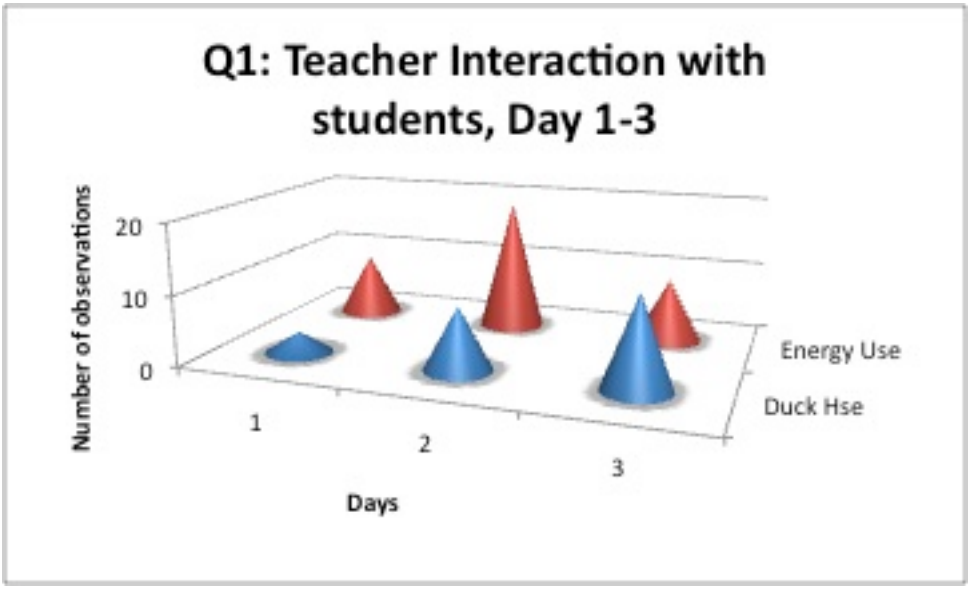


Figure 12. ***T-Interacts with students by asking questions of designs, demonstration and prediction***

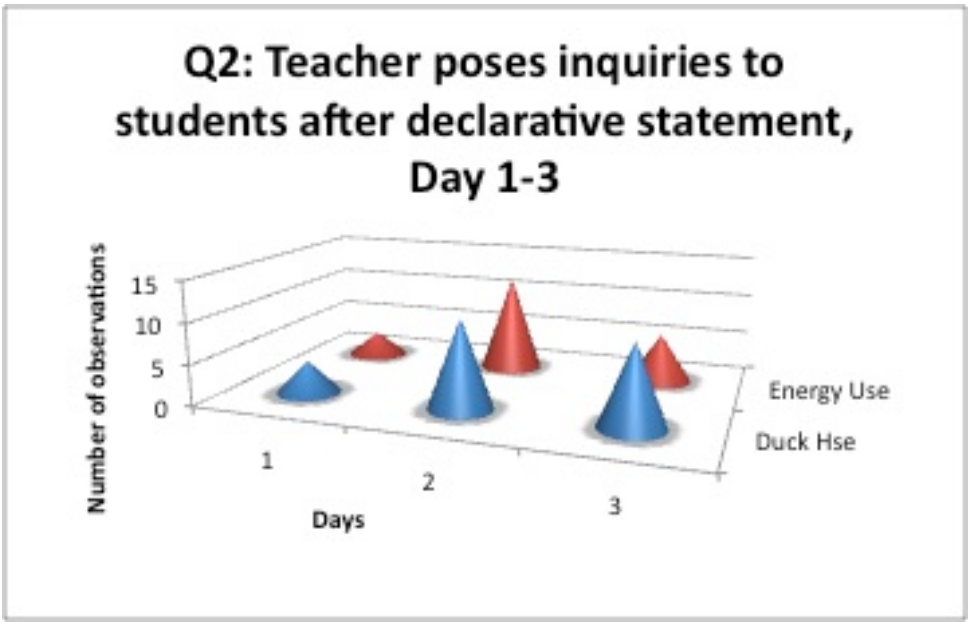


Figure 13. ***T-any declarative statement is followed immediately by a question to make the student think, consider and expound***

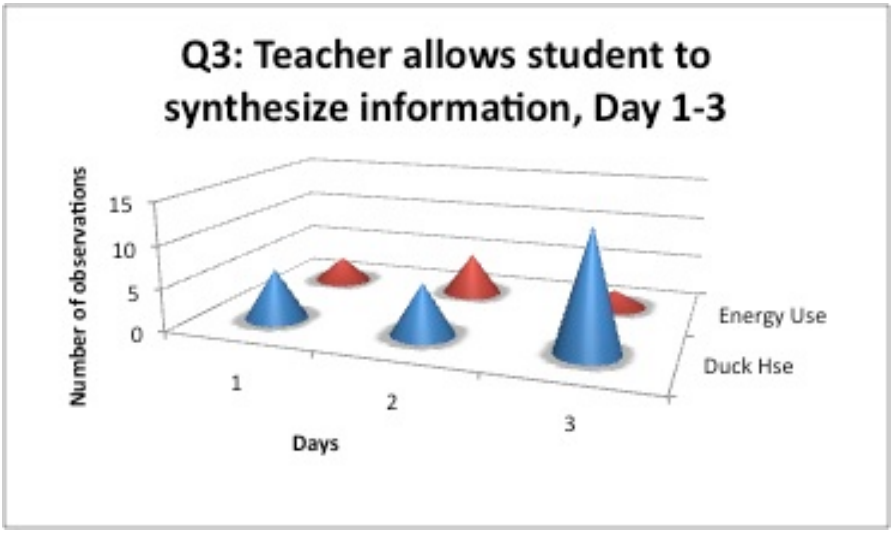


Figure 14.
T-Allow students time to synthesize, experiment, fail and consider alternatives

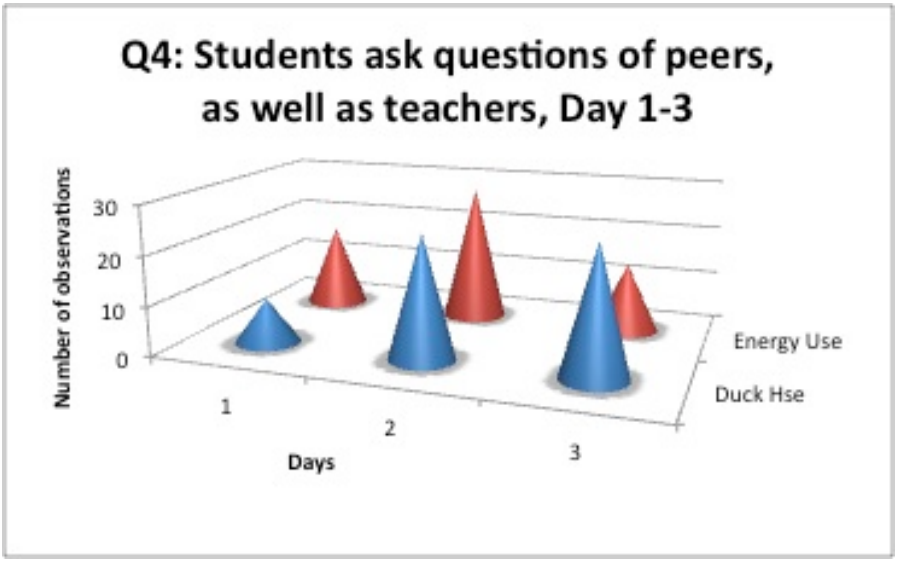


Figure 15.
S-Asking question among peers and team as well as Teacher

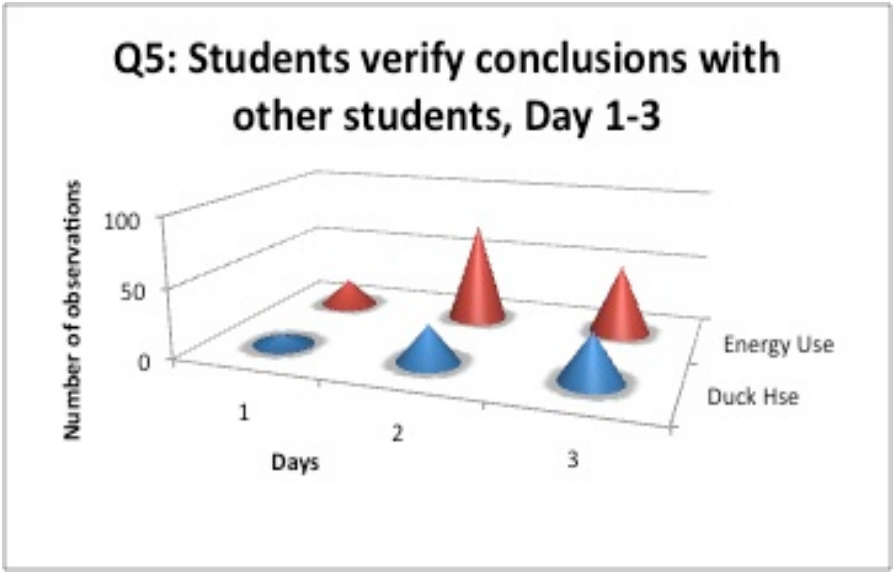


Figure 16.
S-Verifying understandings or conclusions with each other

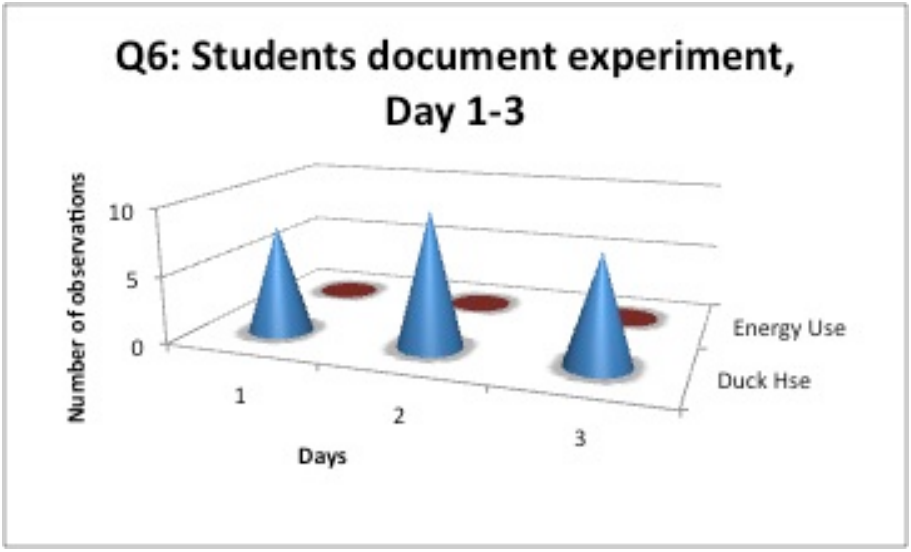


Figure 17.
S-Documenting experimentation

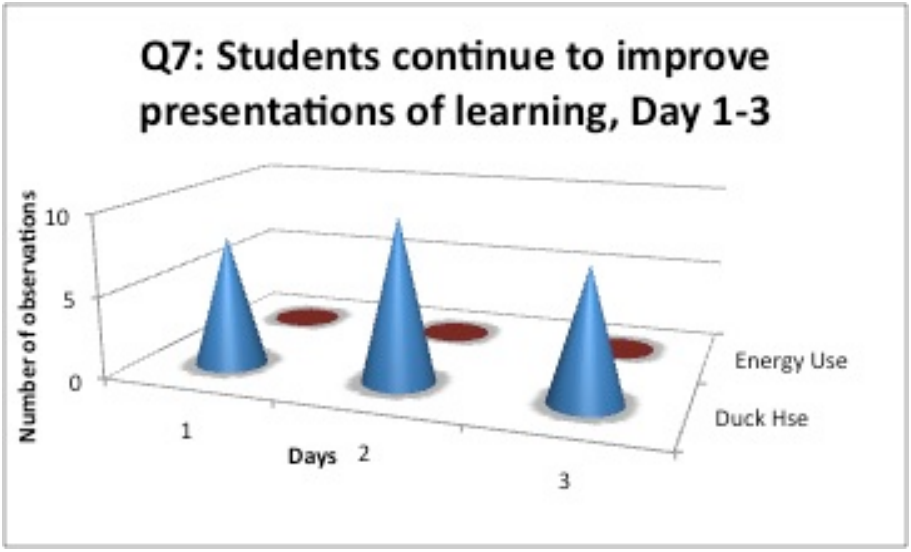


Figure 18.
S-Willing to make multiple drafts of POL to achieve success

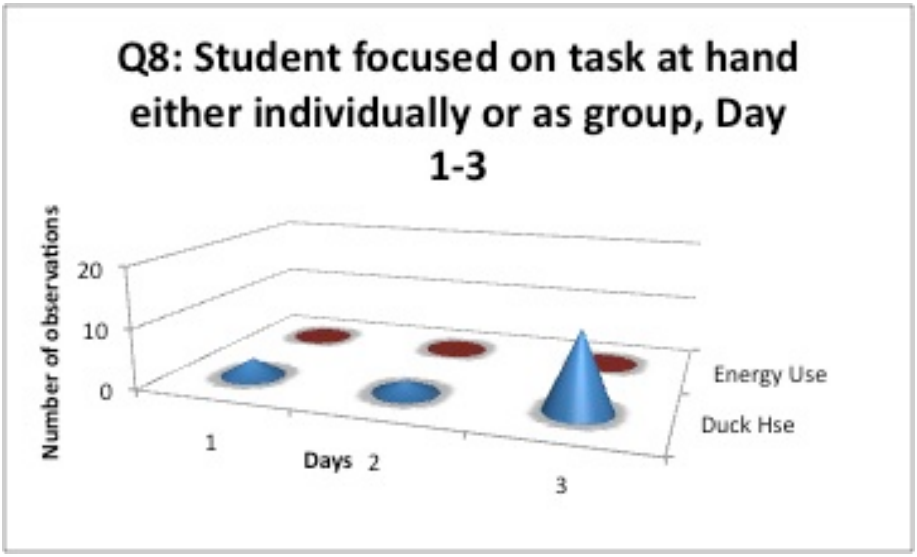


Figure 19.
S-Focused on the task at hand (either working individually or as a group)

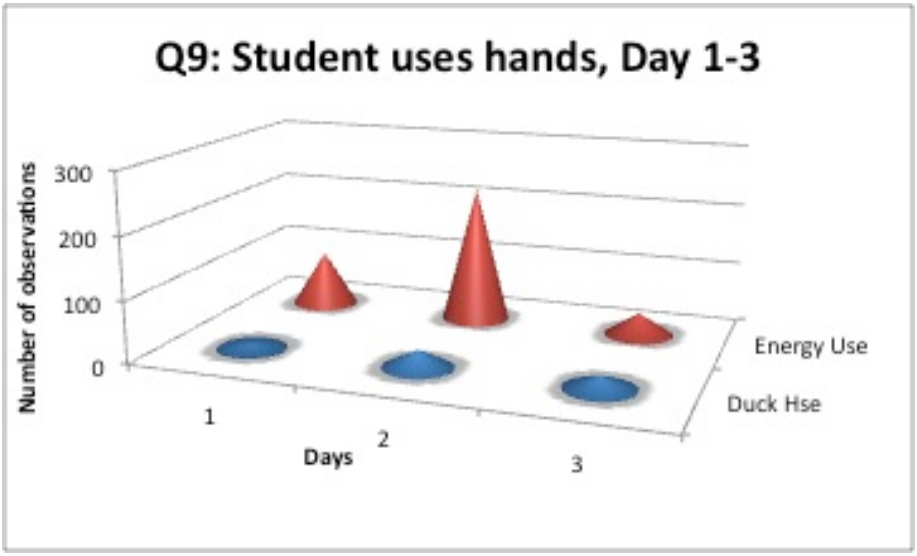


Figure 20.
S-Using their hands

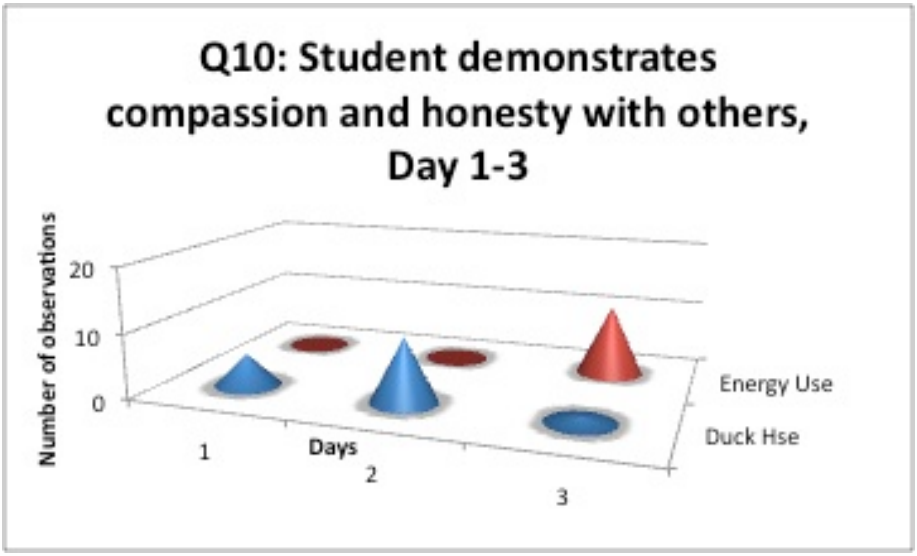


Figure 21.
S-Demonstrates compassion and honesty in interactions

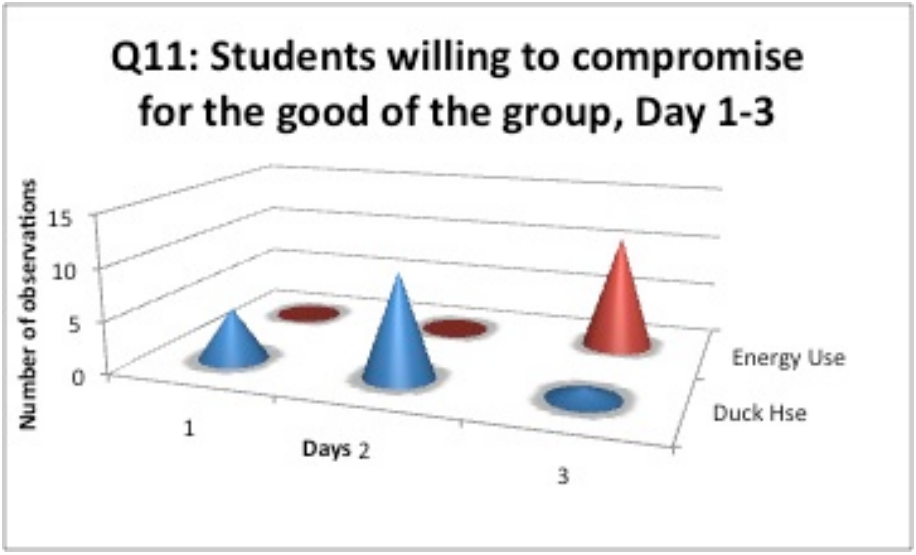


Figure 22.
S-Willing to compromise for good of group