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The Influence of Cognitive Diversity on Group Problem Solving Strategy

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Collaborative group problem solving allows students to wrestle with different interpretations and solutions brought forth by group members, enhancing both critical thinking and problem solving skills. Since problem solving in groups is a common practice in agricultural education, instructors are often put in the position of organizing student groups and facilitating group learning. Research has shown that the factors according to which teachers arrange groups hold great influence over the success experienced by a group. The purpose of this study was to examine how arranging groups by problem solving style influenced group problem solving processes. Groups made up of members with heterogeneous or homogenous problem solving styles were given a problem to solve as a class project. Focus groups were conducted with each group at the conclusion of the project to gain an understanding of how each group progressed through the problem solving process. Differences were found in how homogenous versus heterogeneous groups progressed through the problem solving process. With a greater understanding of how problem solving style influences group dynamics, agricultural educators can be more proactive when assigning student work groups, thereby enhancing students' abilities to work interdependently when creating successful solutions.

Keywords: problem solving, group dynamics, undergraduate students

Introduction

Arranging situations for problem solving is a current best practice in agricultural education because of its numerous proven benefits (Boone, 1990; Cano & Martinez, 1991; Friedel, Irani, Rhoades, Fuhrman, & Gallo, 2008; Phipps, Osborne, Dyer, & Ball, 2008). Due to the structural components of today's workplace, skills associated with problem solving are highly sought, especially when related to working in groups (Gokhale, 1995). The world of education, including primary, secondary, and post–secondary settings (Heller, Keith, & Anderson, 1992), has adopted group problem solving as a teaching technique that not only prepares students for the workforce, but also reaps cognitive benefits as well (Gokhale, 1995; Phipps et al., 2008).

Collaborative group problem solving allows students to wrestle with different interpretations and solutions brought forth by group members, thereby enhancing critical thinking and problem solving skills (Bruner, 1985; Heller et al., 1992; Vygotsky, 1978). The level of success these groups experience is largely dependent on the level of functionality of the group which is partially determined by the group makeup (Heller & Hollabaugh, 1992). Well–formed collaborative groups allow students to "share

their conceptual and procedural knowledge in the joint construction of a problem solution, so that all students are actively engaged in the problem–solving process and differences of opinion are resolved in a reasonable manner" (Heller & Hollabaugh, 1992, p. 637). However, little research has been conducted on the effects of the formation of groups according to different factors, including learning styles or problem–solving style (Gokhale, 1995; Kirton, 2003). While diversity in knowledge and experiences contributes to group learning (Gokhale, 1995), the problem solving styles of individuals in a group can greatly affect the group's ability to collectively solve problems (Kirton, 2003).

As facilitators of learning in group problem solving approaches, agricultural educators are expected to organize student groups into units that will work interdependently and interact in order to arrive at solutions (McClain & Horner, 1988; Phipps et al., 2008). However, group performance based on purposeful group makeup according to problem solving style has not been studied. Assessing the effectiveness of educational programs in agricultural and life sciences and improving the success of students enrolled in agricultural and life sciences academic and technical programs is part of the National Research Agenda: Agricultural Education and Communication, 2007–2010 (Osborne, n.d.). Therefore, a study exploring the effect individual problem–solving style has on the group problem solving process can provide future direction for enhancing agricultural education programs and guiding future practice.

Theoretical Framework

The theoretical framework for this study is based on both Bransford's (1984) IDEAL problem solving framework and Kirton's (2003) Adaption Innovation Theory (A–I Theory).

IDEAL Problem Solving Framework

The IDEAL problem solving framework incorporates the problem solving theories of Newell and Simon (1972), Polya (1957), and Sternberg (1981). Since its creation, the framework has been utilized in both academic and corporate settings (Kirkley, 2003). The five steps included in Bransford's (1984) model correspond to Dewey's problem solving approach, commonly utilized in agricultural education (Phipps et al., 2008). Dewey's approach includes six steps: experiencing a provocative situation, defining the problem, seeking data and information, formulating possible solutions, and evaluating the results. Bransford's IDEAL model follows the same sequence as Dewey's problem solving approach, with the exclusion of Dewey's initial step. Bransford's model assumes the problem solver has already experienced the situation. Figure 1 displays the five steps Bransford identifies as crucial to successful problem solving, as well as the relationships between these steps.

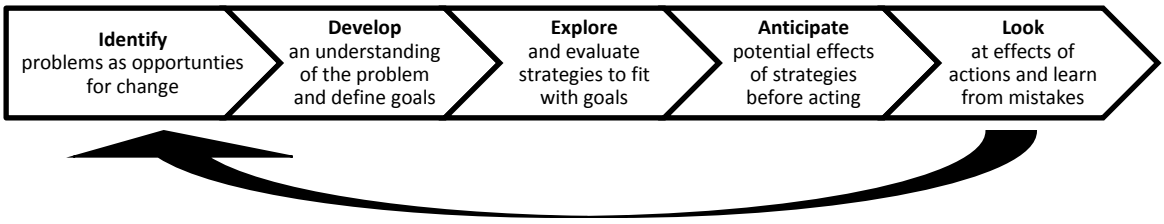

Figure 1. Bransford's (1984) IDEAL problem solving model.

As Figure 1 depicts, the five steps of the IDEAL problem solving model are fluid. They do not occur completely independently of one another, and the boundaries between them can appear fuzzy in observation (Bransford, 1984). Individuals first identify problems that may be present among the *stated* problem. These are problems that can be seen as "inconveniences" or "unpleasant situations," to be tolerated as "facts of life" (Bransford, 1984, p. 12). However, identification of these underlying problems as opportunities for change allows

individuals to solve problems in more creative and often more efficient manners. The next step is to develop a deep understanding of the problem(s), and based on those understandings, define goals that could lead to the problem's solution. While problems may be identified through the first step, the second step focuses on understanding what causes these problems and identifying goals that dissolve the causes (Bransford, 1984). The third step in the framework is to explore alternative approaches to solving the problem and evaluate their relevance to the previously developed goals. Once solutions are developed, the fourth step is to anticipate the potential effects of these solutions before they are acted upon. Finally, once solutions are applied, problem solvers should look at the effects of their efforts and learn from their successes and failures. This final reflection allows for further problem solving, if necessary, as shown by the arrow at the bottom of Figure 1.

Adaption–Innovation Theory

Kirton's (2003) Adaption–Innovation Theory (A–I Theory) examines problem solving on the individual level. Individual problem solving ability is influenced by potential capacity and learned levels of problem solving (Kirton, 1976), however, A–I Theory is strictly concerned with the influence of cognitive style – measuring how individuals prefer to solve problems (Kirton, 2003). According to A–I Theory, cognitive style is "the preferred way in which people responds to and seek to bring about change" (Kirton, 2003, p. 43) resulting in creative problem solving and decision making differences between individuals. Cognitive style variations present in the management of problem solving situations are critical to an individual's problem–solving success and are easily identified through problem–solving situations (Kirton, 2003).

According to A–I theory, individuals' cognitive styles fall on a continuum between adaption and innovation. The scale of adaption–innovation is a continuous range, indicating that individuals' cognitive style can be anywhere between the two; therefore no individual is strictly an adaptor or strictly an innovator. However, individuals with an adaptive tendency prefer more structure when solving problems while those that are more innovative appreciate less structure when working through the problem solving process (Kirton, 2003). When solving problems, individuals exhibiting an adaptive tendency suggest more technically–efficient solutions and seek to develop *better* solutions. Individuals exhibiting an innovative tendency are more novel and seek to develop *different* solutions. Innovative individuals are more likely to require realignment of objectives, plans, or strategies (Foxall, 1986; Kirton, 1999). To innovators, adaptors appear to be safe, conforming, predictable, inflexible, and intolerant of ambiguity (Kirton, 1999, 2003). To adaptors, innovators appear to be exciting, unsound, impractical, risky, abrasive, and threatening to the established system (Kirton, 1999, 2003).

When examining the qualities of adaptors and innovators, including how individuals of each preference view one another, the implications for group work are two–sided. Homogeneous groups, consisting of all adaptors or all innovators, tend to collaborate easily and typically experience success in narrow projects (Kirton, 2003). However, success in broader projects, including several problematic facets, comes with more difficulty to homogeneous groups (Kirton, 2003). When too little structure (increased innovativeness) is present, groups will become inefficient. However, when too much structure (increased adaptive tendency) is offered by group members efficiency boomerangs and the members find themselves trapped in an "inappropriate paradigm or one in dire need of reform" (Kirton, 2003, p. 24).

Alternatively, heterogeneous groups, made up of a mix of adaptors and innovators, can experience communication difficulties due to differences in cognitive style when faced with small projects (Kirton, 2003). In these situations, heterogeneous groups are less effective than homogenous groups (Kirton, 2003). However, homogenous groups are more efficient when presented with a broad range of problems. Individuals exhibiting cognitive differences approach the aspects of problem solving with unique perspectives, offering a variety of resources a homogenous group would not have available (Kirton, 2003). As long as the group members manage their diversity well, homogenous groups are expected to be more successful at large scale problem solving than

heterogeneous groups (Gokhale, 1995; Kirton, 2003).

Purpose & Research Question

The purpose of this study was to examine how grouping by problem solving style influenced the problem solving process. The purpose guided the following research question: How do homogeneous and heterogeneous problem solving style groups utilize the problem solving approach?

Methods

This study utilized the qualitative research method of focus groups to address the research question. Chalofsky (1999) stated "focus groups are carefully planned group meetings designed to collect perceptions and information on a defined area of interest" (p. 1). Unlike group interviews, the facilitator of a focus group encourages interaction among the participants to create an opportunity to share ideas and comment on one another's perspectives (Chalofsky, 1999). While originally designed to collect marketing data, focus groups have more recently been used for program evaluation, program planning, and needs assessment (Krueger & Casey, 2000).

The unit of analysis for this study was focus groups conducted with students who participated in a study abroad course in Costa Rica regarding their perspectives on problem solving in a group setting. The course itself included three weeks of educational sessions combining lectures and field work on agricultural topics including entrepreneurship and sustainability. A problem solving entrepreneurship project was included as part of the course. For the project, each group was asked to create a natural chocolate product from scratch. The project included processing the cocoa beans, making the chocolate, selecting additional ingredients (i.e. flavoring, cookies, nuts, etc.), creating a marketing scheme for their product, marketing the product to a Latin American audience who spoke Spanish as their primary language, and assessing their product's success. Each team was required to have a PowerPoint presentation as part of their marketing scheme and needed to create an instrument to evaluate their success/failure. Minimal guidance during the project was given by the instructors. Instruction included an introduction to chocolate making and basic questions that could be used on their evaluation instruments. Teams were also asked to present the results of their process to the entire class at the conclusion of the problem solving project.

For the entrepreneurship project, the students were broken into teams based on predetermined problem solving style. Kirton's Adaption–Innovation Inventory (KAI; Kirton, 1976) was used to assess problem solving style three weeks prior to the beginning of the course. The KAI instrument was made up of 32–items. To score the KAI, responses are totaled to create an overall participant score that can range between 32 and 160 (Kirton, 2003). Individuals scoring below 95 points are considered adaptors and those scoring 95 or above are considered innovators. Multiple research studies have established a high level of reliability and validity for the KAI (Kirton, 2003). Numerous researchers have also reported high levels of reliability for the KAI with Cronbach's alpha coefficients ranging from .80 to .90 (Taylor, 1989). Eleven students made up the population studied. The students' overall scores ranged from 70 to 120. Six students scored below a 95, classifying them as adaptors, and five students scored a 95 or above, classifying them as innovators. Problem solving style (Kirton, 1999) was then used to divide the students into groups by arranging them by KAI scores (from high to low). This created two homogenous groups (one with three adaptors and the other with four innovators) and a heterogeneous group with three adaptors and one innovator. The students completed the entrepreneurship problem solving project within these predetermined groups. Given the group of students were studied in a specific environment; the results should not be generalized to other populations.

Data Collection

Three focus groups were conducted (one with the homogenous adaptor group, one with the homogenous innovator group, and one with the heterogeneous group). Each focus group lasted approximately one hour. All respondents were coded with a pre–assigned letter designating their group (A = adaptor group; I = innovator group; X = heterogeneous group) and number based on the order that they first spoke

for confidentiality. One facilitator conducted all three focus groups. Prior to starting each session, the facilitator assured the students the information shared would not be associated with them individually. The facilitator allowed the conversation to flow naturally with minimal input. Effort was exerted to gain input from all students by providing multiple opportunities for contribution. The focus groups were audio recorded. Notes were taken at the conclusion of each session regarding the facilitator's observation of student reactions to one another's comments. The audio recordings were transcribed in detail and compared with the recordings for verification and elaboration. Observations, interviews with the course instructors, and student journal entries regarding the problem solving project provided different sources and methods to triangulate the data.

Data Analysis

Once the focus groups were conducted and transcribed, content analysis was used to examine the statements expressed during the focus groups. Content analysis is a process that is "carried out on the basis of explicitly formulated rules and procedures" (Holsti, 1969, p. 3). Content analysis divides data into categories *a priori* and should permit generalization to a theoretical model (Lincoln & Guba, 1985; Neundorf, 2002;). In this case, the IDEAL problem solving model was used to establish the categories prior to analysis (Bransford, 1984).

Two coders were used for the content analysis to lower the amount of observer bias (Lincoln & Guba, 1985). One of the coders did not have any contact with the course planners or the participants themselves. This coder was not familiar with the course content, did not have interaction with participants, and was not informed of the participants' exposure to problem solving prior to data analysis. The second coder was a part of the course planning team, had contact with the participants at the conclusion of the course, and was familiar with the instructional techniques applied throughout the course.

Prior to reviewing the focus group transcriptions, the coders reviewed generalities about the different stages of problem solving together to gain consensus on the identified themes (Lincoln & Guba, 1985). Patterns, themes, and relationships within the data were then identified. At the conclusion of reviewing each groups' discussion of their problem solving process, the coders discussed the group's progression through each of the five problem solving stages. The two coders performed peer reviews by discussing their personal perceptions and generalizations. Together they came to consensus on consistent patterns, themes, and relationships. After reviewing each focus group, the coders used the commonalities and disparities in the patterns, themes, and relationships to create a visual representation of each group's process through the problem solving process. An audit trail was kept throughout the process to ensure trustworthiness (Lincoln & Guba, 1985). Researchers also ensured credibility through triangulation, referential adequacy materials, and peer debriefing (Lincoln & Guba, 1985).

In order to determine transferability of the data resulting from this study, background information on the participants is essential (Lincoln & Guba, 1985). The participants were college–age adult learners participating in the Promoting Sustainability: Training Agricultural Practitioners in the Humid Tropics course at Escuela de Agricultura de la Región Tropical Húmeda (EARTH) University the summer of 2010 in Costa Rica. Demographic data was collected online to describe the population following procedures outlined by Dillman, Smyth, and Christian (2008). The 15 participants recruited to take part in this project represented the University of Florida, Purdue University, and California State University - Pamona. Five of the participants were female and six were male, ranging in age from 20 to 28 years of age. All eleven participants were undergraduates, with two freshman, five sophomores, five juniors, and three seniors. Nine of the participants were White, one was Hispanic, and one was African American. The participants represented diverse educational majors including agricultural business (n =4), animal sciences (n =2), economics (n =4), environmental horticulture (n = 1), and chemistry (n = 1).

Results

Each of the three groups were asked to describe how their group solved the

entrepreneurship project problem, how their group worked together while solving the problem given them, and the strengths and weaknesses they personally exhibited during this process as well as those exhibited by their teammates. Their responses were then compared with the IDEAL problem solving model described by Bransford (1984).

Homogenous Innovator Group

The homogenous innovator group exhibited engagement in all five stages of the IDEAL model. However, there were disparities between the innovator group's problem solving process and the IDEAL model in relation to the timing associated with each stage and the strength of application within each stage. Their problem solving process is exhibited visually in Figure 2.

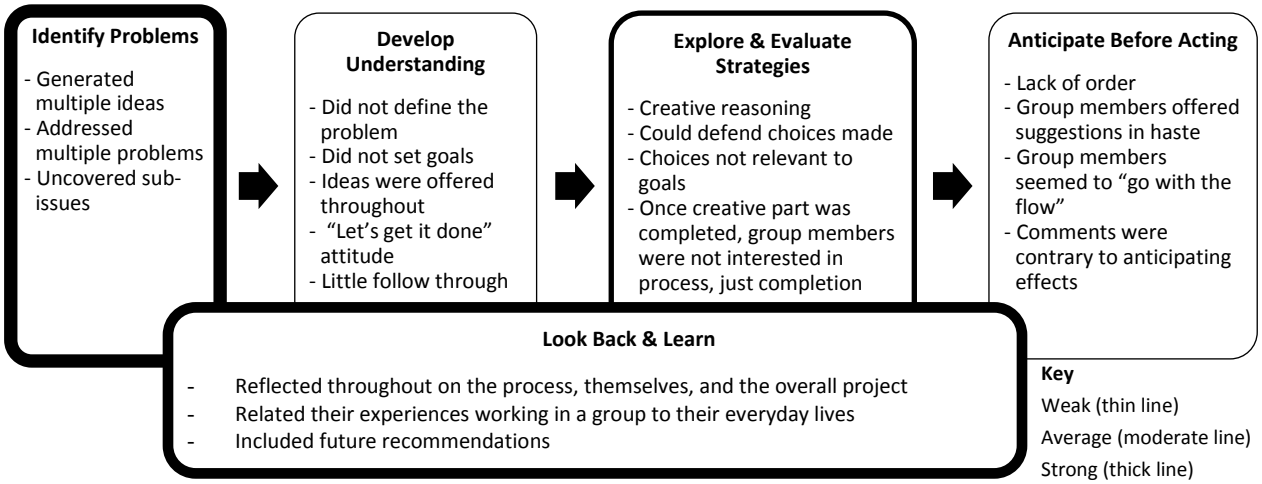

Figure 2. Homogenous innovator group problem solving process.

The innovator group did not struggle with identifying problems and placed a large amount of emphasis on this step of the problem solving model. They referred to brainstorming (PI1, PI2), discussions surrounding multiple alternate solutions (PI3, PI4), and reported an ease in coming up with creative solutions to the large issue and smaller sub–issues (PI4). They felt "pretty much everyone was just saying ideas" (PI1) and that they "were really good at just kind of like coming up with ideas and then picking one" (PI2). This process was easy for them as they "didn't really have too many stumpers where [they] had to sit down and come up with solutions" (PI4).

While this group offered ideas throughout the problem solving process, they did struggle when developing an understanding of the problem. In fact, they discussed not engaging in defining the problem or setting goals. One group member (PI3) clearly articulated this when he said "We never really sat down like as you should do in a marketing study to think about your target audience, your audience, your product, and then you create a marketing plan…" Instead of a clear vision, this group exhibited a "let's get it done" attitude, aiming for completion rather than perfection (PI2, PI3).

While trying to be efficient, this group had very little interest in the project once the creative portion was completed. They felt "if one thing is better than another thing then fine let's just get on with it" (PI3) and wanted to "get it done and then we're going to have free time" (PI2). They did however engage in exploring and evaluating their strategies for success through creative reasoning and being able to defend the decisions they made. When planning to market their product to students at the cafeteria, they thought about their table placement in regards to how they could make the most contact with their audience. Their groups chose to be at a table on the end because "when people walked by [they] didn't want to sit in the middle. I mean you kind

of get overlooked. And if there are people, they're going to come, but people always look at the ends you know?" (PI1). They felt they "had a good spot. We were in the flow. People stopped by our chocolate first" (PI2). It should be noted that the innovator group's comments surrounding their choices were all about making the most contacts. Being able to report a positive response towards the product from the target audience was the goal of this part of the project not the number of contacts.

Group members did discuss anticipating before acting; however it was in hindsight as most of their choices were made in haste. They "kind of just like after we decided to get it done we thought let's do this right though" (PI4). During the chocolate mixing process they "would add more sugar, and then more milk powder to balance it out. It was pretty much a slow process and [we] learned not to rush" (PI2). Some comments were made by the group members in contrary to anticipating before acting including "We're just going to get it done" (PI1) and "Oh the survey. We did that in like a second" (PI2).

The homogenous innovator group's strongest problem solving area was their ability to look back and learn. They did this throughout the problem solving process, as reflection was a key component to their group dynamic. When discussing the project itself they made statements including "The chocolate… we could have made it even better. We could have had time to package it nicely" (PI2) and "Some things could have been tweaked like [Christy] said" (PI1). They also reflected on their group dynamic and how they fit in with the group. One group member (PI3) stated "I'm not responsible by myself. This is a team and we make team decisions and we're not always going to come up with the same solutions…I'm going to go with it and be humble enough to accept that." Another team member (PI1) felt "it's a good learning experience to step back and maybe instead of being the leader to adapt to the surroundings and the situation… it's learning to adapt to your situation."

Their reflections even went a step further, applying what they were learning about themselves to their everyday lives. They felt "learning to adapt to your strengths in this type of situation is a key to life" (PI1) and that they are all "go with the flow people and that's why [they] don't really have any issues getting along here or in our larger lives" (PI2).

Homogenous Adaptor Group

The homogenous adaptor group did not employ all five stages of the IDEAL problem solving model when confronted with the entrepreneurship project. Instead, they spent the majority of their time engaging in conversations surrounding their anticipated action. As a result, this group was the least successful at solving the problem they were presented with. Their problem solving process is exhibited visually in Figure 3.

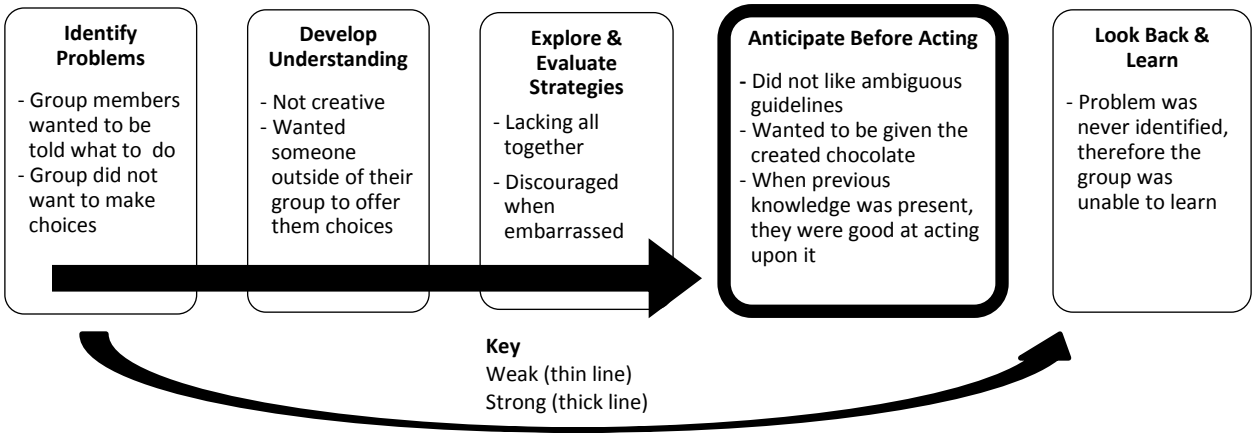

Figure 3. Homogenous adaptor group problem solving process.

Instead of identifying the problem they were presented with, the homogenous adaptor group focused their attention and comments on wanting more information or being told what to do. Comments from group members around wanting/needing more guidance included "We weren't really taught how to cook the product within the chocolate" (PA1), "Tell us before hand so we can plan ahead" (PA3), and "At least we could have been warned ahead of time" (PA2). Since this group felt they were lacking information, awkwardness when making choices was apparent in their comments. When they went to the store to pick out their ingredients they wrestled with what to choose. One of the group members (PA2) stated "We just gotta find something and [what we chose] was kind of what we settled with but the thing was we didn't really know. We didn't really have any ideas before we went." They even reported feeling frustrated by the lack of time offered by the instructors to make choices. One of the group members (PA1) stated "we really didn't have enough time to really look around the store and think about it."

The adaptor group never really developed an understanding of the project. They were not creative in their choices resulting in frustration. This was reflected in statements including "We thought we were just supposed to add something to the chocolate, not necessarily to use the chocolate to put it on something like I saw some other groups" (PA1) and "Our group was under the impression that every single group was going to make chocolate and just sell like a bar of chocolate" (PA2). This lack of understanding led to frustration and embarrassment allowing for very little exploration or evaluation of their strategies. One group member (PA1) stated "I just truly didn't understand why our group was the only group that messed up…I just didn't understand like what we really did wrong." All three group members reported being embarrassed by their lack of success. This emotion was portrayed by PA1 when he stated

> When the entrepreneurship [instructor] laughs at it while loving everyone else's it's just like well I'm going to sit behind the table. I'm not going to go out and try to get people to come eat chocolate they don't want and that we're not proud of.

As stated earlier, the adaptor group spent the majority of their time anticipating action. They got stuck on this step of the problem solving process, and it appeared to restrict their ability to work through the rest of the process. The lack of structure offered by the instructors left them feeling lost. This team wanted to be able to plan ahead and even expressed a desire to be given the product initially rather than having to create it on their own. They felt there should have been "more of a focus on just one project cause you can learn a lot through entrepreneurism, but it take a little more time than just the time that we spent on it" (PA1). They felt the instructors told them to just "sit down and figure something out and find some ideas… we really didn't have enough time" (PA1). PA3 stated "If we actually had like this is how you do chocolate, this is what you do with your chocolate. Tell us before hand so we can plan ahead." PA2 also wanted more notice and stated "at least we could have been warned ahead of time."

However, the homogenous adaptor group did express feelings of success when working on parts of the project that were dependent upon their previous knowledge. They enjoyed measuring their success, and presenting their project to the class, as they had previous knowledge of PowerPoint and Excel. "We had a great presentation/slide show because [Danielle] took a thousand pictures so we had like the best documentation of it. That was our biggest asset" (PA1). When measuring success they "plugged it all into Excel. And I mean you know made statistics" (PA2). With the data, they "decided what [they] wanted to talk about, the three main points that [they] wanted to make with the information [they] gathered" (PA1). They split up the work in this situation based on their strengths and each group member had "one specific job [they] worked on so [they] all could look at it at the end and say this looks good, you're going to talk about it in the presentation… [they] all contributed" (PA1).

The adaptor group was never able to look back and learn from their process since a problem was never really identified initially. Instead, they discussed how they "tried to keep a good attitude and stay positive and stay happy and calm and confident as [they] could be" (PA1). They felt it "could have been a better

experience for sure if [their] chocolate had actually turned out" (PA2).

Heterogeneous Group

The heterogeneous group employed all five stages of the IDEAL problem solving model simultaneously. Their problem solving process is exhibited visually in Figure 4. Reflection on how they worked together and the process itself happened throughout the entire project and was the main source of combined problem identification. They felt there "were some parts that were kind of tense but that happens in the real world so [they] think that is good that [they] experienced it on a small scale where you learn through those situations" (PX1). They also felt "any frustrations that any of [them] had were not related to working together but was more due to disorganization and circumstance of whatever [they] were doing at the time" (PX4). They also accepted that "none of [them] had ever done it before and none of [them] were experts so none of [them] knew the right way" (PX1). While working together, they accepted one another's differences and "sort of adjusted to that… kind of reflected the fact that it wasn't, there wasn't much at stake in this project" (RX3). They "really didn't feel like it was a big deal" (RX2).

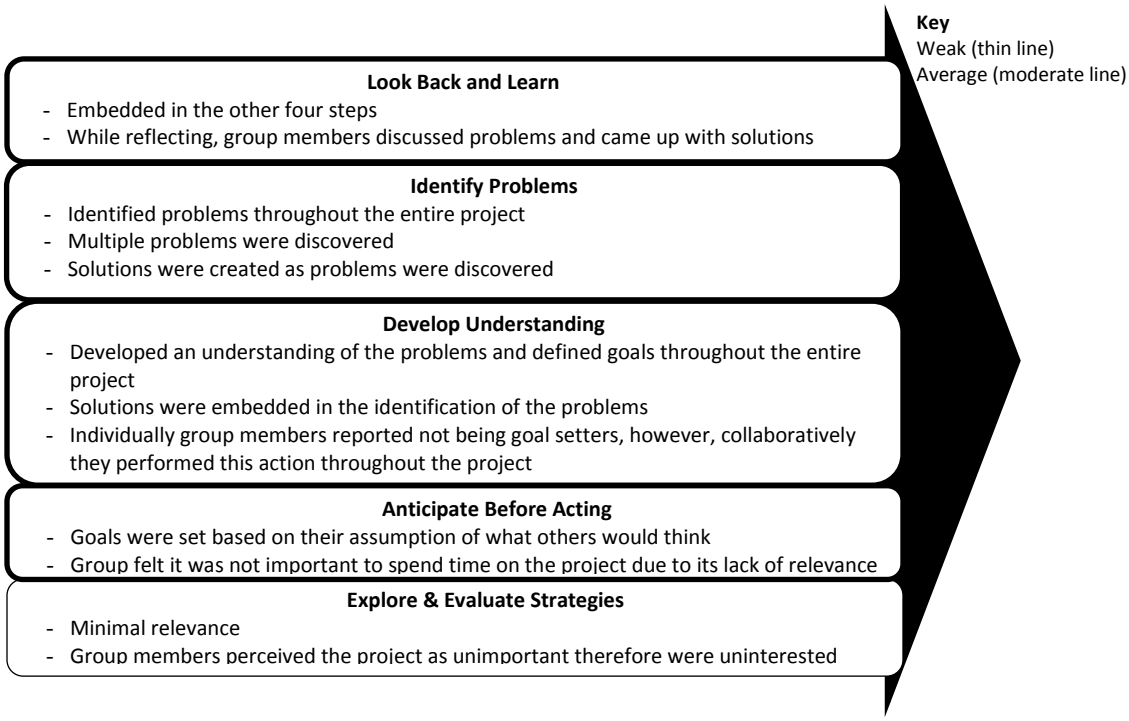

Figure 4. Heterogeneous group problem solving process.

This group identified multiple problems through the project including problems working together (PX1, PX2, PX3, PX4), problems with the overall project (PX3, PX2), problems with developing a marketing plan (PX4), problems with creating tables (PX2), problems with the language barrier (PX1), and problems with the overall study abroad course (PX1, PX4). The group was able to come up with solutions and felt they "all had [their] role… and [they] were all pretty much utilized" (PX2). While the group identified problems with the project and course organization, they felt these problems

> gave [them] the opportunity to enhance [their] skills and think that without the disorganization [James] is right. Like, [they] wouldn't have seen what [they] could do. I mean, so I think sometimes things like work out in mysterious ways and that's probably one of them (PX1).

Since the group developed an understanding of the problems and created solutions while identifying them, goals were created during the group discussions. For example, they discovered language was going to be a problem when marketing their product so they "tried to think of a theme that would like catch a general college student's attention" (PX1) and then "worked together to translate" (PX2). Their "group was the only one that did it in Spanish" (PX4). The group members all reflected on not being team oriented in their normal lives when setting goals, however in this setting they were able to work collaboratively. PX1 stated "I'll be the first one to admit that it's not that I don't care about other people's ideas… but if it works it works and you don't necessarily have to look for something that works a little bit better." While PX4 felt "I want to do this the best way possible the first time…versus just getting it done… I had to just let it go sometimes and be like okay it's not a big deal."

This team anticipated what others would expect of them while setting their goals. They felt it was "probably important that [their presentation] looks good" (PX1) and "liked the fact that [they] were more formal for [their] presentation versus the other groups" (PX3). One group member (PX1) stated "When I'm in a situation where I'm representing other people in my group or even just like [University] it just really bothers me that people would stand up and do something [silly]." They were also concerned with how their audience would feel about their campaign. They felt "it's kind of conceited for us to come in and say we're going to market something to you in our language because we're Americans" (PX1) and spent a lot of time translating their materials into Spanish.

Conclusions

All three groups progressed through the problem solving model differently, as exhibited visually in Figures 2, 3, and 4. The homogenous innovator group utilized all five stages of the IDEAL problem solving model (Bransford, 1984). This result is not surprising. Innovators typically prefer to solve problems with less structure (Kirton, 2003), as was provided in the presented problem. The innovative group's strengths were apparent in the identifying problems stage and the look back and learn stage which is consistent with Kirton's A–I Theory that suggests innovators seek to develop different solutions. Rather than reflecting and learning from their efforts at the conclusion of the process as Bransford's model suggests, the group shared reflective insight throughout the entire project. Their weaknesses as a group were in the developing an understanding and anticipating before acting stages, which are consistent with previous research showing innovators often need realignment of objectives and can be seen as risky, willing to jump into things before fully thinking them through (Foxall, 1986; Kirton, 1999).

The homogenous adaptor group did not utilize all five stages of the IDEAL problem solving model (Bransford, 1984). Instead, this group spent the majority of their time in the anticipating before acting stage. They strongly disliked the ambiguous guidelines offered by the professors, which is consistent with A–I Theory (Kirton, 2003) that suggests adaptors prefer structure, are less flexible, and are intolerant of ambiguity. Because the group focused so intently on anticipating before acting, they could not progress through any of the other stages of the problem solving process with any depth. As a result, this group was slower than the other groups in developing their product, never created a high quality product, and was embarrassed by their results.

The heterogeneous group utilized all five stages of the IDEAL problem solving model simultaneously (Bransford, 1984). Unlike Bransford's model, which suggests a linear approach to problem solving, this group combined the stages by reflecting throughout the process. They worked together to identify problems, created solutions as problems were identified, came up with goals while creating solutions, and thoroughly anticipated what others would think of their solutions throughout the process. Interestingly enough, the group members reported that this is not how they normally work, but that in this setting they were able to work collaboratively. The results are consistent with Kirton's (2003) A–I Theory, claiming individuals exhibiting cognitive differences bring unique perspectives and offer more resources for solving broad problems.

Implications/Recommendations

The key implication for agricultural educators working to enhance educational programs is to be aware of, and address, the impact individual problem solving style can have on group dynamics. Agricultural educators, as facilitators of group problem solving approaches, need to organize student groups into diverse units that can work interdependently and interact to create successful solutions (McClain & Horner, 1988; Phipps et al., 2008). This study shows there are benefits and drawbacks to how groups with homogenous and heterogeneous problem solving style members work together. Since skills associated with problem solving are highly sought after in the workforce, especially when related to working in groups (Gokhale, 1995), educators need to consider problem solving style when implementing strategies that focus on building student capacity.

Increasing student awareness of their own problem solving style and how that style complements/challenges the problem solving styles of others can also be used as a tool in the classroom to enhance student awareness of their own cognitive tendencies. This study shows there are differences in how groups interact based on group members' problem solving style. Educators should consider using reflective sessions at the conclusion of group activities to discuss the problem solving process, and the interpersonal interactions that emerged between group members due to problem solving style similarities and differences. The insight students can gain from reflecting on their relationships with others, and how those relationships assisted/detracted from the problem solving process, will assist them in building stronger collaborations when working in groups and teams in the future.

Additional research measuring the impact homogenous and heterogeneous problem solving style grouping has on student learning and engagement in a more typical classroom environment, rather than during a study abroad course, would assist in determining if the results found here are localized to this population and/or setting. In addition, research examining whether or not the complexity and ambiguity of the problem presented had an effect on the results could assist in further understanding how homogenous and heterogeneous groups differ in how they approach problem solving.

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