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TECHNICAL EDUCATION NETWORKING PROGRAM

LEARNING GROUP FORMATION FACTORS IN A CAREER AND TECHNICAL
EDUCATION NETWORKING PROGRAM

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LEARNING GROUP FORMATION FACTORS IN A CAREER AND TECHNICAL
EDUCATION NETWORKING PROGRAM

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Abstract

Team based learning based on the transformation of permanent student groups into powerful learning teams is widely and successfully used as an instructional strategy in postsecondary career and technical education. Failure of groups to reach the learning team status is a major learning drawback of this approach. Factors affecting the transformation of groups to teams are applied consistently to the whole class, with the exception of group formation and membership. Career and technical education populations differ from other postsecondary populations and examination of group formation factors may result in improvement of student results.

Keywords: groups, transformative, diversity, career, technical, active research

TBL Group Formation Factors in CTE Networking Programs

Introduction

Team based learning (TBL) is widely used in classroom instruction to develop professional competencies key to career and technical education (CTE). TBL is centered on four principles: permanent groups, class readiness, meaningful group activities, and student feedback. Groups are formed at the beginning of the class, and remain constant throughout the term. Students are expected to come to class prepared, and a readiness assurance process (RAP) is implemented to assess and enforce pre-class reading. Group activities stress significant problems, with the same problems presented to all groups. Student feedback is accomplished using both peer review, and instructor feedback at all stages of TBL classes. Additional individual assignments and assessments are also used within the TBL structure.

While there is a large body of literature on TBL, only a small part of the literature is comprised of studies examining the success of individual groups in this teaching approach. All groups in a class are exposed to the same environment during a TBL class, so examination of group composition and formation may uncover factors key to successful group function.

Problem Statement

Group function failure is a risk of using TBL. In a diverse classroom, one factor leading to failure is that needed resources may not be present in a group. The one item that cannot be applied equally to all students in a TBL classroom is group membership. Student population of postsecondary CTE programs is very diverse in academic and demographic make-up, presenting group formation issues not found in more consistent populations. Student paths through the coursework in a computer networking CTE program vary widely. A diverse population of students is typically enrolled in the Computer and Networking Technology (CNT) program.

Diversity is defined as variance of age, ability, motivation, background, and life circumstances in the student population. The diverse CTE population present challenges in TBL group formation.

Purpose of Study

The purpose of the study was to determine if using a survey instrument as part of inputs in the group formation step of a TBL class requiring identification of key student resources would result in improvement in the groups selected. Key resources for any single class are identified from the backgrounds and abilities of the students enrolled, and can vary every semester.

Literature Review

Team Based Learning

Fink (2002) identifies three types of group use in classrooms: casual, structured activities, and transformational. The use of casual and structured activity types do not require permanent group structure or feedback. TBL is based on transformational use of groups with permanent student assignments. Students displayed increased learning competencies when placed in permanent groups and presented with both individual responsibility and relevant group activities. The transformation of groups into learning teams is the goal of TBL strategy (Michaelsen & Sweet, 2009).

Once the decision to use a TBL classroom strategy is made, permanent groups are formed and group activities dominate classroom instruction. The four key components of TBL include: group formation, individual responsibility, group activities with real world problems, and peer assessment. The successful transformation of the group into a learning team depends on group make-up and activities (Sisk, 2011; Michaelsen & Sweet, 2009).

Michaelsen and Sweet (2009) stress transparency in group formation, and assigning students to groups during the first class period. Students are asked questions and instructed to line up (single file) along a wall or hallway according to answers. Groups are set by counting off by the number of desired groups, and using a simple 1, 2, 3, 4 . . . count selection process. Students identified by any question asked are not further ordered by subsequent questions. A typical series of questions and actions for an upper division business administration class might be:

1. How many students are finance majors? (line them up in front)
2. How many are other business majors? (place these next in the line)
3. How many are math, science, or computing majors? (place these next in the line)
4. Now all remaining students line up at the end.
5. Since we want groups of 6 or 7 students, in this class of sixty, count off one to nine and then repeat, starting at the first student. (students count off)

The result of this series would be six groups of seven, and three groups of six in the class, with finance and business majors distributed to all groups if possible.

Individuals and groups have defined responsibilities. Individuals must prepare before class, and formative readiness assessments measure both individual and group preparedness. Groups meet during class periods to address shared problems and activities. Group activities include the same readiness assurance tests taken by individuals. The first step toward team transformation occurs when students realize that the group performs better on these initial assessments than individuals (Fink, 2002; Michaelsen & Sweet, 2009).

The transformation step from groups to learning teams is not automatic. Group activities and peer assessment designed into curriculum allow shared experiences and feedback, which

enables but does not guarantee successful learning team results. Gomez, Wu, and Passerini (2010) stress the social interaction within groups as a positive factor in transition to learning teams. Groups develop their own rules and procedures. When learning teams do result, class performance in readiness and assigned activities is generally raised, as individuals prepare better, and gain insights from fellow students as well as instructors. Student satisfaction and involvement also increase when the transformation to a learning team occurs (Birmingham & McChord, 2002; Aragon, Woo, & Marvel, 2004).

CTE Instruction

CTE programs develop academic and professional competencies key to employment in a number of career clusters through learning in situations closely related to an actual job environment (Treeton, 2007). Educational programs are designed to meet knowledge and skills necessary to perform in individual career pathways as identified in conjunction with industry (States' Career Clusters Initiative, 2010).

The student population of postsecondary CTE programs is very diverse in academic and demographic make-up. Legislative funding support and educational approaches to CTE have encouraged inclusion of a range of populations in postsecondary programs, including those based on race, age, historical treatment, job displacement, and economic status. Student populations in CTE postsecondary programs include individuals with a wider range of academic preparation, abilities and motivation than comparative traditional degree programs (Scott & Sarkees-Wircenski, 2008; Treeton, 2007).

Group learning approaches are included in CTE instruction for this study to reflect workplace environments, use lab resources efficiently, and accomplish student learning in limited duration programs. Students do not have the economic resources for extended programs,

and hands-on lab resources may not be available on an individual basis (Scott & Sarkees-Wircenski, 2008).

Instructional factors in CTE approaches using TBL

Group to Team Transformation. Desired results for both TBL and CTE are met if student groups do transform into learning teams. It is acknowledged that some groups will not meet this goal of transformation (Fink, 2002). Events under the control of the instructor after group creation are consistent for the whole class, so it is reasonable to examine the group formation steps when seeking to minimize probability of the failure to achieve group to learning team transformation.

Course objectives and content must be appropriate, and assessments must be reliable before attempting to examine the success of TBL as an intervention. In initial class periods, there is a learning curve for students to gain skills in the TBL approach which is time-consuming and requires planning (Sisk, 2011).

The CTE student population presents significant challenges to group success that involve autonomy, appropriate social interaction, and task focus. The probability of group failure in the TBL intervention is reduced through the use of readiness assessments, realistic group activities with immediate feedback, and use of individual accountability of group members (Birmingham & McChord, 2002; Michaelsen & Sweet, 2009). The accountability aspect is identified as a primary difference between TBL and less intensive group approaches (Sweet & Pelton-Sweet, 2008).

Group composition is the one class factor that is not common to all students. TBL sets a number of group selection goals and identifies some selection method criteria for successful groups. Goals include adequate size, equal distribution of skills, diversity, and visible

demonstration of fairness in selection (Birmingham & McChord, 2002; Michaelsen & Sweet, 2009; Fink, 2002).

Strategies for group selection set desired group size at five to seven members to increase the pool of talent and reduce the impact of loss or non-performance of one or more members. Important skills identified in class design should be distributed throughout the groups, with every group including members with vital skills. Diversity of views is identified as important to allow wide-ranging discussion, and to avoid cliques within groups. Visible fairness in selection of groups reduces initial student perceptions of inequality in group composition (Michaelsen & Sweet, 2009; Fink, 2002; Streuling, 2002; Goodson, 2002). Additionally, Streuling (2002) identifies self-selection, random selection, and use of GPA for group formation methods as increasing chances of group failure to transform into learning teams.

Career and technical education also offers limitations to applying TBL group creation strategies. Unlike the relatively consistent populations presented by Michealsen (2002), the CTE networking program populations present challenges in identifying and distributing key resources needed for group and class success. The initial action research project phase will pursue identification of key resources needed for success in group transformation to learning teams. The skills, diversity, and knowledge present in a typical class of 20 students are often unclear on the first day of a TBL networking class. If identifying the mix of talents needed for group success is successful, then an additional active research phase will address selection instruments or other items to improve TBL group formation from the class population.

Limitations imposed in the TBL process to achieve CTE goals represent a challenge to overcome in creating groups that can transform to powerful learning teams. Though student learning and satisfaction is increased when the transformation to a learning team occurs, this is

not a guaranteed event in any TBL environment. Michaelsen (2002) uses a public process to select TBL groups during the first class period by asking a question to identify students with greatest knowledge and having those line up along a wall, then using additional questions to select students with lesser qualifications. Then students in the line simply count out numbers (1, 2, 3,4, etc) to accomplish group selection.

Method

The Server Operating Systems class in a two-year Computer and Networking Technology (CNT) program was selected for study. This class is designed around an unfolding case study, and serves as a key assessment point and one of two capstones of the AAS degree in CNT. It is desirable that key academic and hands-on skills be present in every TBL group, but not all students taking the class have those skills. Fifteen students in the class studied completed the study consent form (see Appendix 1) and their data is included in the tables in Appendix 3. Two students completed the survey form and were included in the group assignments but their data was not included in the data tables in Appendix 3.

There is a direct conflict between the TBL goal of adequate group size (five to seven members) and hands-on student skills development. This conflict leads to group sizes of four to five members in CNT classes with lab components. Having smaller groups spreads the pool of available skills, and this in turn presents challenges in identifying students with vital skills and ensuring equal distribution. The class selected used group sizes of five or six students in three groups to ensure adequate access to computers and other project equipment for all students.

Michaelsen's group selection process was altered by having students fill in a paper survey form (see Appendix 2) during the first class to allow identification of specific needed resources. Forms were evaluated between the first and second class meeting, and groups were

assigned using a filtering process for this course similar to Michaelsen's method but with additional review based on identifying which key resources are scarce in the class, and ensuring that each group contained key resources, and that all key resources were allocated equally between groups. Group assignments for the remainder of the term were made during the second class meeting.

Completed student survey forms were tabulated to identify which resources in the class were key to group formation. The open-ended questions included in the survey were used only in final choices of group selection after responses were considered. Appendix 3 includes response groupings in five tables: Years since high school or GED graduation, Work Experience, CNT courses completed, Student certifications earned, and Student years at the university. As resources were identified, individual survey sheets were placed in piles for each group, and could be moved between piles as the diversity and resources within each group were considered. Moving the survey sheets from pile to pile allowed review and comparison of all responses when considering student allocation (and re-allocation) between groups.

The Server Operating Systems class has only one specific prerequisite, a networking concepts and communication class. Student backgrounds ranged from the minimum prerequisite to years of industry experience. One summative assessment requirement of the class is that each student prepares a final report for their completed server project which has four major knowledge areas: server systems, domain computing, firewalls and remote access, and process documentation. Computer and network security is included in application of every knowledge area. Examination of student responses to the survey allowed assignment of at least one student with knowledge of each of the four major knowledge areas to every group. Some groups had two or more major knowledge areas represented by a single student after the process.

Limitations

Introduction of the TBL learning model into any specific learning environment accepts the risk of group failure to achieve team status to the detriment of members in that group, even though overall class performance is improved. Attempting adjustment to parts of the TBL model or to CTE goals can improve performance in one while harming the other. Since the duration of a postsecondary educational exposure may be only months, failed adjustment attempts can carry a negative impact well beyond the end of student contact.

The desirable TBL impacts of increased student-to-student learning, and greater class accomplishment may not overcome issues with student and group autonomy, appropriate social interaction, and task focus. Additionally, other unknown factors may have adverse impact on classes where adjustments are attempted. This study does not explore results for variable group outcomes beyond those associated with the group formation step using a survey instrument in TBL.

Timetable and Activities

Institutional Review Board approval was secured as an exempt project on August 20, 2013. Subject consent forms were completed by all participating students before survey form data was completed the first day of class on August 27, 2013. Two students did not complete the consent form. Groups were formed and announced in class on August 29, 2013. The class was presented as an evolving case study with periodic status reports by student groups and a final report from all students individually due on December 6, 2013.

The unfolding case study in the class included eight separate measurable tasks: Adoption of standards and policies, network creation and management, X-operating system installation and administration, Windows Server 2008 installation and administration, remote administration,

unattended backup (with restore), domain user creation and resource mapping, and full system documentation. One student dropped the class before completion.

Results

Survey instrument results (see attached Table 3) were used in the process of determining final teams. Years since GED or high school graduation (Table 1) were calculated from survey results, with 66% of students having ten or more years since graduation. The adjustment made to group construction was to balance the students with less than ten years since graduation between all groups. Work experience (Table 2) indicated that 53% of students were currently employed in the Information Technology (IT) industry and these were also used to ensure a balance between groups. Information from these first two items were applied as part for final group balancing, as they were not resources in scarce supply.

CNT courses completed (Table 3) and Student certification earned (Table 4) were key to group assignment. The key resource that was least represented in the course population was security (represented by 4 students completing CNT 264, and one of those earning the Security+ certification), and this became the first consideration in creating groups. Another resource identified as key in the class studied was disk drive technology experience (represented by 6 students completing CNT 180). Examination of survey responses showed that three of the four key security students were also key disk technology students. These three students were the first assignment to the three class groups.

Only one of the written response questions was used in group assignment. The written response questions were only used in one area. Student years at UAA (Table 5) had a minor role in group assignment. Final review indicated that one group was assigned three students (out of

four in the whole class) who had been at UAA for four years. Moving one student to another group achieved an improvement in this area.

The final assignments ensured that each group created contained at least one student who had a security and hard drive technology background, and minimum variations in work experience, years since high school, and UAA experience.

All students and teams did achieve learning team status. Evidence of this is indicated by 100% individual and team completion of all case study tasks. Additionally, individual documentation packages from members of each group included group themed and formatted material. Individual documentation packages varied from 32 to over 60 pages, and all included group-specific presentation of key group tasks.

Conclusion

Team based learning is an educational approach that is successful in postsecondary programs. Applying the TBL approach to career and technical education can result in improved class performance, but is subject to limitations of the student population and educational goals. Failure of one or more groups in a class to achieve learning team transformation lessens benefits to those students.

Events under the control of the instructor after group creation are consistent for the whole class, so it is reasonable to examine the group formation steps when seeking to maximize the probability of the group to learning team transformation occurring. Identifying key group formation factors in a CTE environment is a key component in improving classroom performance in TBL. In this study, the TBL group selection process was altered by having students fill in a paper survey form in the first class to allow identification of two or three necessary resources for each team. Forms were evaluated between the first and second class, and

groups were assigned using a filtering process similar to Michaelsen's method but also being reviewed to ensure each group had key resources, and that all key resources were allocated fairly between groups.

Analysis of individual student survey responses for key resources allowed the instructor to improve group balance of resources. All groups and individuals completing the class demonstrated success in all eight of the case study tasks. Three students who represented both of the key resources in the class were assigned to separate groups, ensuring that each group had access to the resources.

In future evolution of this active research sequence alterations to the survey instrument for group assignment should be considered. Alteration to the short answer questions included in the survey might make the student responses more useful.

Other areas of the TBL model can be considered. Increased use of individual assignments to supplement group activities, adjusting grading to reflect more (or less) individual responsibility, and alternatives or supplements to group activities may increase student performance. Peer review may be increased or decreased in importance. Learning tools can be introduced to make group interaction and collaboration easier. However, attempting to identify and adjust other group success factors simultaneously with group formation intervention will make it difficult to determine what changes cause any observed changes to student learning.

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Appendix 1

Consent Form

CONSENT FORM

PRINCIPAL INVESTIGATOR:

George R. Plunkett
Associate Professor, Computer Networking and Office Technology
University of Alaska Anchorage (907) 786-6470

DESCRIPTION:

I am interested in the factors which contribute to the success in groups in a Team Based Learning (TBL) approach to networking classes. You, as a Computer and Networking Technology (CNT) student are well-suited to describe the processes, thoughts and feelings experienced in the class. This research study may involve one or more follow-up questionnaires given in the normal sequence of the course.

VOLUNTARY NATURE OF PARTICIPATION:

Your participation in this study is voluntary. If you don't wish to participate, or would like to end your participation in this study, there will be no penalty or loss of benefits to you to which you are otherwise entitled. In other words, you are free to make your own choice about being in this study or not, and may quit at any time without penalty.

CONFIDENTIALITY:

Questionnaires will be used by class instructor for learning group selection. For the purposes of the class, no personal information will be released beyond your name on the list of learning groups for the class (which will NOT be published as part of research project documentation). Your name and personal identifiers will be removed before data is transcribed will not be attached to your interview responses. Selected responses to follow-up questionnaires may be published with all personal identifiers removed. Your name and any other identifiers will be kept in a locked file that is only accessible to me or my research associates. Any information from this study that is published will not identify you by name.

BENEFITS:

There will be no direct benefit to you from participating in this study beyond possible improvement of soft skills applicable to job situations. The results of this study may benefit other TBL classes by improving class design.

RISKS:

It is possible responding to questionnaire items may make you uncomfortable. However, there are no other known risks to you.

CONTACT PEOPLE:

If you have any questions about this research, please contact the Principal Investigator at the phone number listed above. If you have any questions about your rights as a research subject, please contact Dr. Dianne Toebe, Compliance Officer, at (907) 786-1099.

SIGNATURE:

Your signature on this consent form indicates that you fully understand the above study, what is being asked of you in this study, and that you are signing this voluntarily. If you have any questions about this study, please feel free to ask them now or at any time throughout the study.

Signature _____ Date _____
Printed Name _____ A copy of this consent form is available for you to keep.

Appendix 2

Student Questionnaire – Group Selection

Student Questionnaire – Group Selection

Name: _____ Year Graduated for HS (or Equivalent): _____

Circle appropriate answers below

Work Experience

IT employment: current: none ½ time full time

It employment: historical : none ½ time full time

CNT Classes completed (circle all that apply):

CNT 180 (A+, interfacing)

CNT 183 (LAN)

CNT 240 (Windows essentials)

CNT 264 (Information Security)

CNT 170-261 (Cisco 1-2)

CNT 270-271 (Cisco 3-4)

Certifications Held (and date)

A+

Net+

CCNA

Others: (list)

How many years have you attended UAA?

What is your favorite computer program or application?

What is the most important aspect of computer servers?

What is the most important aspect of (computer) networking?

Information on this questionnaire will be used for research and educational purposes only. No questionnaire date will be stored or reported with personal identifiers.