Assessment of openness as a dynamic team skill in order to counteract "free-riding"

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Abstract—**Group work is frequently used in higher education to prepare students for their future work roles and to foster the development of interpersonal and social skills. Such skills may be of particular importance when solving complex problems, in study situations as well as in real life. However, students often report on problems in group work and teachers face difficulties in making fair assessments of the individuals' contribution. This paper emphasizes the development of openness as an essential team skill for enabling successful group work, to counteract free-riding, and to facilitate teachers in making fair assessments. With the use of a questionnaire for peer assessments of team skills, we measured openness in 23 groups from two different courses—one with students who know each other well and one with students who just met. In a comparison of the two student groups, we conclude that students with a history of working together exhibited more openness, thus speaking in favor of group work running over a longer period of time. We consider the operationalization of the concept openness as the main contribution here, in addition to the empirical result.**

Keywords—peer-assessment, group work, team skills

I. INTRODUCTION

An important focus of higher education is to prepare the students for the challenges they are likely to encounter in their future work roles. For students enrolled in the subjects referred to as STEM (science, technology, engineering and mathematics), this includes to support their development of team skills along with related abilities such as communication and leadership, which are often sought by employers. To be exposed to group work is often considered a successful approach for the students to accomplish these desirable skills. It is also so that the STEM students often work with problems that are so complex and multifaceted that they are best solved by a team of individuals contributing with different views and ideas.

While group work is a popular instructional tool in higher education, it is not without its problems and students often report issues and conflicts of different kinds. One frequently occurring problem relates to the behavior of "free-riding" (also known as social loafing) which occurs when one or more members of a group do not contribute with their fair share of the work load required of the joint group project [1]. Another challenge with group work relates to evaluation and assessment. It is difficult for teachers to gain insight into the students' group processes since most of the work takes place outside of the classroom. It is especially difficult for a teacher to adequately assess the contribution of individuals to a group project and to take these into account when assigning grades [2]. One popular approach for the teacher to gain insight into a group's work process is the use of peer- and/or self-assessments. This approach allows all group members to assess themselves and/or each other and provide the teacher with a report of the group members' contribution to their joint project. To gain insights into each and everyone's

contributions in a group could prove beneficial for the teacher when it comes to assigning grades. However, it is our belief that the work process is just one dimension of teamwork that is relevant to address. We would also like to put forward the development of team skills as another important dimension for students in higher education to gain the learning benefits of group work as is its pedagogical purpose.

In this paper, we report on a study with the aim to assess team skills and discuss how teachers in higher education can scaffold students in acquiring the team skills necessary for their future work roles. We emphasize the behavior and team skill of openness [3] as an essential skill for enabling successful group work and counteracting free-riding behavior. With the use of a questionnaire for peer assessments of team skills [4], we present different strategies for openness and confirm that students with a history of working together exhibits more openness.

II. THEORETICAL BACKGROUND

Preparing students for the world of future work and for the challenges they are likely to encounter in their future work tasks is an important focus of higher education. In many situations, this includes to ensure that students learn how to work in groups. In fact, group work has a number of learning benefits that are difficult to achieve otherwise. These benefits include an increased exposure to different views and ideas, an opportunity to experience and learn about group dynamics, and to develop interpersonal and social skills often highly sought by employers—e.g., communication skills, leadership, planning and time management [5]. Group work also enable students to work on larger, more complex and multifaceted problems than what is suitable for individually based projects [6]. While group work is a popular instructional tool in higher education, it is not without its challenges and research on group development emphasizes that it takes time for a group to reach a stage of productivity and work. In fact, several of the most pertinent theories on group development put forward the idea that all groups, irrespective of what type of group or what their purpose might be, move through different phases or stages of group development. These theories also agree on the idea that a group in earlier stages of development puts a majority of their efforts and energy on managing the relationships within the groups, setting up goals, and assign roles. A group, therefore, needs to move through the different phases of development to reach the later phases during which they can devote their energy to the actual task they have been given [3, 7-9].

One of the most established theories on group development was presented by the communication expert William Schutz. During the 1950s, he formulated the theory called "Fundamental Interpersonal Relationship Orientation" (FIRO) which since then has been used excessively in both research and for analyzing interrelationships and communication patterns in different kinds of group work. The

theory presents three dimensions of interpersonal behavior that are of importance in groups: Inclusion, Control, and Affection/Openness [3, 7]. According to Schutz [3], these three behaviors indicate different phases in the development of human relationships. Inclusion refers to the initial phase when the group members need to establish and maintain satisfactory interactions; Control refers to the second phase which concerns the exercise of power, influence, and authority; and Openness is the end point of the developing relationship and concerns care and affection, and the sharing of feelings and thoughts. The behaviors presented by Schutz map well with the stages of group development put forward by Tuckman [8] with the "Forming, Storming, Norming, Performing model" and Wheelan [9] in the "Integrative Model of Group Development" (IMGD). In general, the theories seem to agree that the first phase of group work is an orientation phase during which the group members get to know each other and create a feeling of belonging. This relates to the behavior of inclusion and to establish the interpersonal relationships within the group. The next phase usually presents some degree of conflict and opposition as the group members start to realize that they might have different expectations on the work process or different ideas on how to best solve the task at hand. This behavior relates to control and developing structure within the group. As the group members resolve the conflicts and form a division of tasks, the group can move on to a phase during which their joint efforts can be aimed towards solving the task they have been given. In this phase, openness should be considered important to enable the group members to maintain a successful communication and collaboration.

As can be seen in the models of group development, conflicts are a natural part of group work. However, that does not take away the fact that the conflict might be challenging to handle when they arise. To enable the students to reach the learning benefits of group work, it is desirable that the group experience ends in a constructive way that allow the students to develop their team skills. One way to remedy the difficulties with group work is the use of peer- and/or self-assessments. These have taken many forms during the years but the essential idea is to ask all group members to evaluate their own contributions (self-assessment) or each other's contributions (peer-assessment) to the work process and/or to the final group deliverable [4]. These assessments could support the group members to proceed in the group development phases and meanwhile provide the teacher with increased insight into the group's work process. However, there are some dilemmas associated with asking students to assess their contributions. For example, high achieving students tend to underrate their performance and vice versa for the lower achieving students. There is also a general tendency for all students to overrate their own work when the assessments are used for grading purposes [10-11]. When it comes to assessing one's peers, the results could be affected by social factors such as peer pressure, friendship, or conflicts between the individuals in the group [12]. Despite these potential downsides, [2] report positive effects of self-and peer-assessments when it comes to students' involvement and their motivation for actively participating in group work. Their use of self-and peer-assessments also resulted in a low occurrence of free-riding, which is in line with the results of [1].

In the present study, we used the ideas derived from the group development theories and the method of using peer-assessments in group work as the foundation. Considering Schutz's term of openness as the final stage of group development and the positive effects openness brings to the group when the members are able to communicate straightforwardly, sharing feelings and thoughts with each other, we believe openness can counteract the occurrence of free riding behavior. Accordingly, we start with the following general hypothesis: the more openness in a group, the less likely it is to encounter the issue of free-riding.

III. METHOD

A. Material

In order to assess dynamic team skills as a way to understand individual contributions in group projects, a questionnaire for peer assessments was used. It is a tool for students to discuss and rate their relative contribution to the effective functioning of the team (Gibbs, 1994). The questionnaire consists of eight different aspects, with five levels of contribution ("well below average", "below average", "average", "above average" and "well above average") for each aspect (see Table 1). The levels of contribution are all associated with a pre-determined score ranging from -2 for "well below average" to +2 for "well above average".

TABLE I. ASPECTS OF TEAM FUNCTIONING AND THE LEVELS OF CONTRIBUTION AS PRESENTED TO THE STUDENTS

Aspects of team functioning	Levels of contribution				
	Well below average	Below average	Average	Above average	Well above average
1: Forming good team cohesion	-2	-1	0	+1	+1
2: Leadership, managing meetings	-2	-1	0	+1	+1
3: Planning and allocating tasks	-2	-1	0	+1	+1
4: Generating ideas and solutions	-2	-1	0	+1	+1
5: Tackling team social problems	-2	-1	0	+1	+1
6: Organising individuals to do jobs	-2	-1	0	+1	+1
7: Helping team members to finish jobs	-2	-1	0	+1	+1
8: Willingly taking on unpopular jobs	-2	-1	0	+1	+1

The group was supposed to collectively decide on where on the scale that each group member should be placed for all eight aspects. When combining all the individual assessments within the group, the sum of each aspect should equal zero (0). This means that, if one group member has contributed more than average, someone else in the group must have contributed less than average. Accordingly, the scoring process should be viewed as an exercise on how openly the group members can communicate with each other in regards to the individuals' contributions to the group work. On group level, "openness" is operationalized in terms of how much or how little the group vary their scores over all eight aspects. Accordingly, if a group reports "average" contribution on many or all aspects for all group members they exhibit no or low degrees of openness. Similarly, a group that reports their contribution with "well below average" and "well above average" exhibits a high degree of openness. With help of the questionnaire, openness can also be analyzed on a more detailed level by analyzing each individual aspect separately, i.e. the degree to which the groups vary their scores on each of the eight aspects.

B. Participants

The questionnaire was distributed to students in two different courses: one Human Factors (HF) course and one Human, Technology & Organization (HTO) course. Both were advanced courses (Masters level) and in an interdisciplinary subject. While the students in the HF course did not know each other before taking this particular course, the students in the HTO course had been classmates for several years. The HTO course was given in the fourth year of a five year long educational program and so the students had been classmates for quite some time, while the HF course was offered as a separate course mainly intended for students studying abroad. The HF course was taught in English and the other one in Swedish (for the latter, the questionnaire was translated into Swedish). In both courses, the students performed group work in groups of three-four students per group. The structuring of the courses and the assignments given were very similar in regards to its pedagogical setup. Specifically, the assignments were such that they encouraged the students to work together, both in regards to the high workload imposed by the task but also in regards to the complexity of the assignments.

In the HF-course, there were a total of 57 students, out of which 54 completed the course. Altogether, there were 15 groups in this course, but only 14 participated in the peer-assessment exercise. In the HTO-course, there were 32 students, out of which 30 completed the course. There were a total of 8 groups in this course, and all participated in the peer-assessment exercise.

C. Procedure

All groups were informed at the beginning of a seminar that they, at the end of that seminar, were invited to participate in the exercise as described above. They were also informed that the exercise was not a compulsory part of the course, and that the result of the exercise would not affect the grades they were given in the course. In fact, it was emphasized that the exercise was part of a teacher training course as a way for the teachers to better understand the dynamics of group work. They were also informed about the importance to discuss all group members' contributions within the groups and therefore to write the name of each member on the form reporting that particular student's

contribution. This means that the groups received and filled in as many questionnaires as they were a total of members in the group (one form per student). The students filled in the questionnaires while seated in the classroom.

On the questionnaire, it was described that the contributions of each and every group member should be assessed in relation to the contribution of the others so that the sum of each aspect in the end should equal zero. This was also emphasized orally when the questionnaire was distributed to the groups. Some of the groups asked for clarifications regarding this part of the instructions while filling in the questionnaires.

IV. RESULTS

In order to prepare for analysis, the questionnaires were checked to find out how well the groups had understood the instructions. 10 of the 14 groups in the HF-course had completed the questionnaires according to the instructions. The corresponding number for the HTO-course was six out of eight groups. All together 16 of the 22 groups had completed the questionnaires correctly. The remaining six groups (4+2) did not succeed in following the instructions. A separate analysis of these groups' responses showed that instead of getting the mean zero on the eight individual aspects in the questionnaire, these groups distributed positive and negative ratings for all individuals and across all aspects. In all six groups, the positive ratings had been exaggerated indicating that all group members contributed better than average (which of course, could not be possible). The result is similar to the findings in [10] and [11], even though the students in the present study were aware of the fact that their assessments would not be used for grading purposes. The results of these six groups are not further considered in this study.

A. Group level results

For the remaining 16 groups, analyses on group level were conducted as a first level of analysis. The purpose of doing the analyses at group level was to discover different response patterns. The first response pattern that could be identified was that one group applied a strict average strategy over all eight aspects in the questionnaire. For all individuals in the group, they reported average contribution on all aspects. This group was either not able to, or willing to, discuss individual contributions and differences therein for the members of the group in relation to any part of the group work. This behavior will be called a defense strategy. This group was from the HF-course which has students from all over the world with no previous relationship to each other.

The second and third response patterns are similar to each other, and entails to avoid the extreme values of -2 and +2. These strategies were used by four groups, all part of the HF-course. We will call these response patterns caution strategies. Two of the four groups report differences between individuals on three out of the eight aspects. For the remaining five aspects, they use the same defense strategy as described above. This strategy will be labelled great caution strategy. The other two groups report differences between group members on six out of eight aspects. We call this strategy limited caution strategy.

The fourth and fifth response patterns are used by groups that, to different extent, use the extreme values of -2 and +2 to assess the contributions of the individuals in the group. We call these response patterns for openness strategies. The first

of these strategies is labelled limited openness and the six groups that utilize this strategy use between one and four of the extreme values. We label the final strategy great openness, and the groups that show this response pattern use between five and eleven of the extreme values.

Based on the analysis that resulted in these five response patterns, and consequently five strategies for doing peer-assessments, an openness dimension (Table 2) ranging from low openness that can be seen in the Defense strategy, to high openness visible in the Great openness strategy. Table 2 above shows the openness dimension and the frequency of groups for each of the five strategies, and for each of the two courses in the study (HF and HTO).

B. Results for separate variables

Table 3 shows the frequencies of responses for each of the eight aspects of the questionnaire, for both courses as well as the total score. As can be seen, three aspects have high frequencies of neutral responses, i.e. these three aspects are the ones where the students rank each other's contributions to be very equal. These three aspects are: 1. Forming good team cohesion; 5. Tackling team social problems; and 7. Helping team members to finish jobs. The first of these aspects (number 1. Forming good team cohesion) is the only aspect were there are no extreme values (-2 or +2) reported.

Two of the eight aspects show a rather scattered response pattern, with frequencies distributed over all the five levels of contribution ("well below average", "below average", "average", "above average" and "well above average"). These aspects are: 2. Leadership, managing meetings; and 6. Organizing individuals to do jobs. Three aspects have an intermediate response pattern, with frequencies distributed over all five components, but still with emphasis on the neutral responses. These aspects are: 3. Planning and allocating tasks; 4. Generating ideas and solutions; and 8. Willingly taking on unpopular jobs. The last one (number 8. Willingly taking on unpopular jobs), reports the highest number of extreme values.

TABLE II. FREQUENCIES OF RESPONSE PATTERNS FOR THE OPENNESS DIMENSION

The openness dimension divided into five response patterns				
Defense strategy	Great caution strategy	Limited caution strategy	Limited openness strategy	Great openness strategy
1 (HF)	2 (HF)	2 (HF)	1 (HF) + 5 (HTO)	4 (HF) + 1 (HTO)

Finally, there were some differences between the two courses in focus for this study, i.e. differences in response patterns derived from the peer-assessments made by the students in the HF-course compared to the students in the HTO-course. Therefore, it is relevant to show responses in percentage for some of the aspects in the questionnaire. Table 4 shows the differences between the two courses for the neutral level of contribution (called "average" in the questionnaire) for all of the eight aspects. Noticeably, there were no differences for two of the aspects (number 1 and 4), and only minor differences for aspect 3 and 7. For the rest of the aspects, however, there were rather large differences between the courses, with the HF-course showing a higher degree of neutral frequencies on all four aspects (number 2, 5, 6 and 8). Students in this course thus showed less openness on these components in the peer-assessment. The HF-course had students coming together from more than ten different countries and naturally, they had no precious relationship to each other.

TABLE III. FREQUENCIES OF RESPONSES FOR ALL ASPECTS, FOR EACH COURSE, AND IN TOTAL

Aspects of team functioning	Frequencies of responses					
	Course	-2	-1	0	+1	+1
1: Forming good team cohesion	HF	0	2	33	2	0
	HTO	0	1	20	1	0
	Total	**0**	**3**	**53**	**3**	**0**
2: Leadership, managing meetings	HF	0	13	13	9	2
	HTO	1	8	5	6	2
	Total	**1**	**21**	**18**	**15**	**4**
3: Planning and allocating tasks	HF	2	7	18	9	1
	HTO	1	4	12	4	1
	Total	**3**	**11**	**30**	**13**	**2**
4: Generating ideas and solutions	HF	3	6	20	4	4
	HTO	0	5	12	5	0
	Total	**3**	**11**	**32**	**9**	**4**
5: Tackling team social problems	HF	1	2	31	2	1
	HTO	0	3	16	3	0
	Total	**1**	**5**	**47**	**5**	**1**
6: Organising individuals to do jobs	HF	1	10	16	8	2
	HTO	2	8	5	2	5
	Total	**3**	**18**	**21**	**10**	**7**
7: Helping team members to finish jobs	HF	2	4	24	6	1
	HTO	0	5	13	3	1
	Total	**2**	**9**	**37**	**9**	**2**
8: Willingly taking on unpopular jobs	HF	4	4	20	6	3
	HTO	4	4	7	2	5
	Total	**8**	**8**	**27**	**8**	**8**

TABLE IV.   PERCENTAGES OF RESPONSES FOR THE NEUTRAL COMPONENT ON BOTH COURSES AND OVER ALL ASPECTS

Course	The eight aspects of team functioning							
	1	2	3	4	5	6	7	8
HF-course	89%	35%	49%	54%	84%	43%	65%	54%
HTO-course	91%	23%	55%	55%	73%	23%	59%	32%

V.   DISCUSSION

In general, the students in the HF-course (those who did not know each other prior to this particular course) exhibit less openness at the end of the group work. The reason for this can be interpreted in different ways. One perspective is that this is an effect of the students not knowing each other and therefore spending more time in the first stages of group development, compared to the other students that might already have gone through those stages in previous group assignments. The fact that the students in the HTO-course (those with a history of working together) exhibited more openness also goes hand in hand with the group development theories suggesting that group members need some time to "grow together" to reach a stage of openness (which should also be noted as the stage of productivity). This perspective speaks in favor of designing courses in such a way that the group work continues over a longer period of time. One might even consider to keep the same group constellations over several courses to make sure that the students have enough time to successfully move through the first stages of group development. We regard this as a reminder of the importance to consider team skill development as a separate dimension complementing the dimension of work process, and that both are relevant to acknowledge in future peer- and self-assessments of team work.

There is another potential explanation for the results showing that students in the HTO-course exhibit more openness than the students in HF-course, and this perspective relates to motivation. While the students in the HTO-course are enrolled in an educational program, in which this course is part of, most of the students in the HF-course take the course as a separate course. The fact that the HTO-students are dependent on this course to be able to, in the future, graduate from the program could potentially mean that they have higher internal motivation than the students in the HF-course. On the other hand, many of the students in the HF-course are international master students with non-EU citizen membership and have therefore paid a fee to the University prior to registering to this course. It is therefore not likely that their motivations were strikingly lower.

A third possible explanation for the differences in results between the two courses may relate to cultural differences affecting the students' perspectives on roles, division of tasks, and how to establish equal responsibility within the group so that everyone takes responsibility for the work process and the output it will lead up to. The students in the HTO-course were all Swedish citizens. These students are accustomed to a non-hierarchical organization of group work as part of their social study environment. It is not clear whether students in the HF-course expect the group work to be organized in the same non-hierarchical manner but we expect that this is not the case. On the contrary, there is anecdotal evidence that some of the male students with a cultural background that are very different to the Swedish culture tend to assume the role of organizer of the group work. In our observations, we have noticed that these students want to be in charge of the final product but are not necessarily involved in developing that said product. This way of acting is of course closely related to the perception of openness and the group's journey towards openness as the final stage of group development. The subject of culture is comprehensive and since it is not the main focus of this study, we will leave it with suggesting that cultural differences might affect openness within a group. This also points to the importance of providing the students with clear instruction not just related to the assignment as such, but also instructions related to how to work in groups and how to be a good team member.

A fourth explanation for the differences seen in this study has to do with the operationalization of openness as it is used in this paper. We started with Schutz' definition of openness as the final stage of the developing relationship, with its emphasis on care and affection among the group members. We then reasoned that any group of students that has reached this level of dynamic team skills will exhibit different behaviors than a group that has not yet reached the same level. The use of the questionnaire by Gibbs [4] is one of several possible assessments methods that can be used in order to measure differences in behavior between such groups. One advantage we found with Gibbs questionnaire was that it mixes items related to work processes and items focusing on team skills. That enabled us to make two predictions. Firstly, we could expect groups with more openness to exhibit the behavior of using more extreme values on all items compared to groups with less openness. Secondly, we could expect that some items would be more difficult for the groups in regards to exhibiting openness, e.g. "forming good team cohesion", and "tackling team social problems". Since this is an ad-hoc exploratory study with preliminary data, we expect that similar results could be found also with another operationalization of openness.

The operationalization of openness also relates to the main objective of this paper: How can teachers in higher education scaffold students in acquiring the team skills necessary for their future work roles? If we assume that characteristics that develop openness are an important part of the ability to collaborate on equal terms, then it is important to separate these characteristics from other parts of the process of group work, such as for example tasks you can handle individually and that are easier to distribute and follow up on. In this way, our operationalization shows that scaffolding students in acquiring work process related skills, like planning and organization of work, as well as leadership, is easier to assess since these skills may not require as high openness as the subtle, and potentially more desirable, skills do. For the subtle skills, for example generating ideas and solutions, and allocating tasks, it may not be as easy.

A. Future work

This study suggests that students that know each other from previously possess more openness within the group and we ask ourselves if they, due to their increased openness, encounter fewer cases of free riding behavior. Considering the group development theories, it would be possible to assume that a group that has moved through the first stages of group development and reached the stage where they have developed well-functioning patterns of communication would have tools to counteract free riding. We believe so, and we therefore believe that the development of dynamic team skills is a way to counteract free-riding. This is something to look deeper into in a future study since the present study should be considered as an initial step in this direction.

Another interesting aspect for future work relates to the use of peer assessments as a formative evaluation during the process of group work with the purpose of measuring if the exercise of regularly doing peer-assessments can strengthen the group's communication patterns and increase openness. Prior research suggests that peer-assessments increase students' motivation and engagement [2] and we believe that this feeling can scaffold a group to successfully move through the phases of group development. Feeling motivated might help the group to push through difficulties and if a formative use of peer-assessments increase motivation, we ask ourselves if the degree of openness within a group would be increased by a regular use of peer-assessments during the process of group work.

Yet another aspect that could be interesting to look into is whether or not the degree of openness corresponds to the group's achievement and final grade. According to the group development theories, a group needs to move through the different phases of development to reach the later phases during which they can put their energy into solving the task they have been given. This is also where, according to Schutz [3, 7], the group reaches openness and it would therefore be interesting to investigate if a higher degree of openness will result in better solutions to the assignments, thus, if openness corresponds to the quality of the final group product or the grade that the students are given based on their final results.

VI. CONCLUSIONS

When comparing the results of the two student groups, one in which the students knew each other prior to this course, and one in which they did not, we draw the conclusion that students with a history of working together exhibited more openness when measured across all items on a peer-assessment questionnaire. Openness were categorized in terms of different response patterns, or strategies, and students with a history of working together also exhibited a lower level of neutral responses on six out of eight aspects in the peer-assessment, which are interpreted as a display of more openness among these student groups.

For skills associated with the social dimension of group work, it is concluded that it is difficult to assess these skills with quantitative assessments in a way that is meaningful. This because the groups that exhibit high openness also can be reluctant to discriminate the group members' contributions to this social dimension.

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