

Chapter 3

Experiments, Evaluations and Measures

3.1 Design of the Experiment

The design of the surveying experiment followed the standard procedures of behavioral science research [1,2]. Initially, a base line was established before the intervention took place. Subsequently, sample points were planned at different times to track the impact of the event. A decision was taken to design a specific survey tool in order to reflect the uniqueness of this research. The full survey catalogue is attached in Appendix B while Appendix C includes the improved ones. The graph below indicates how the original experiment was designed.

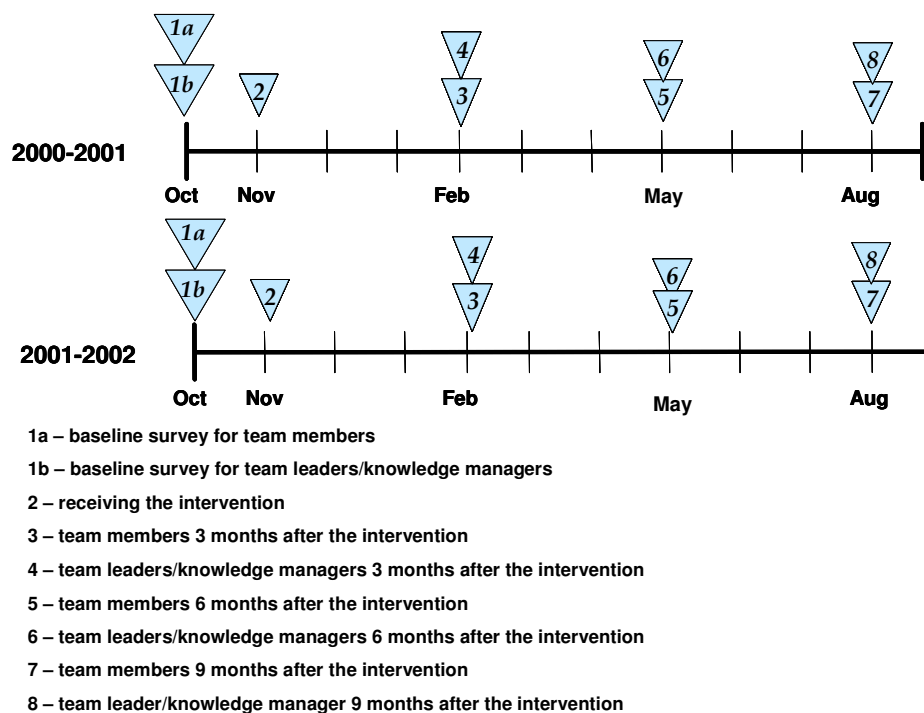


Figure 3.1. Initial planning for surveying baselines and student opinions

The academic year started in September/October. This is when the students (team members - 1st year students; team leaders and knowledge managers – 4th year students) had to respond to survey number 1, i.e. the baseline assessment. Consecutively, the same populations received the intervention (in this case “Enhancing Team Performance©”). This is reflected in the chart, as sampling point number 2. Immediately at the end of the intervention students had to fill out another survey. Survey number 2 has the prime purpose of getting feedback on content and delivery.

The next sample point was planned to take place approximately 3 months later (sampling point number 3 and 4). Here differentiation between team members and team leaders/knowledge managers is in place. The reason for this segmentation is to observe whether there are any differences in perception

depending on roles. In addition it was intended to see whether any variation of team leader's and knowledge manager's behavior reflected on the team members. The segmentation was also valid for the next chart point, which was planned to take place after six months (sampling point number 5 and 6). At this point in time it was of interest to find out which part of education had the greatest impact, to identify areas of improvement and to look for first signs of sustainability or retention [2]. The last sampling point was planned for 9 months after receiving the intervention, targeted at long term sustainability and the extent to which the skills were built.

For various reasons, the original design of the survey process and its sample points was not sustainable and had to be revised, as shown in Figure 3.2. It would be adequate to admit that the logistical effort to translate (from English into Catalan), distribute, fill-out, track, collect, evaluate, and translate back (from Catalan into English) was underestimated.

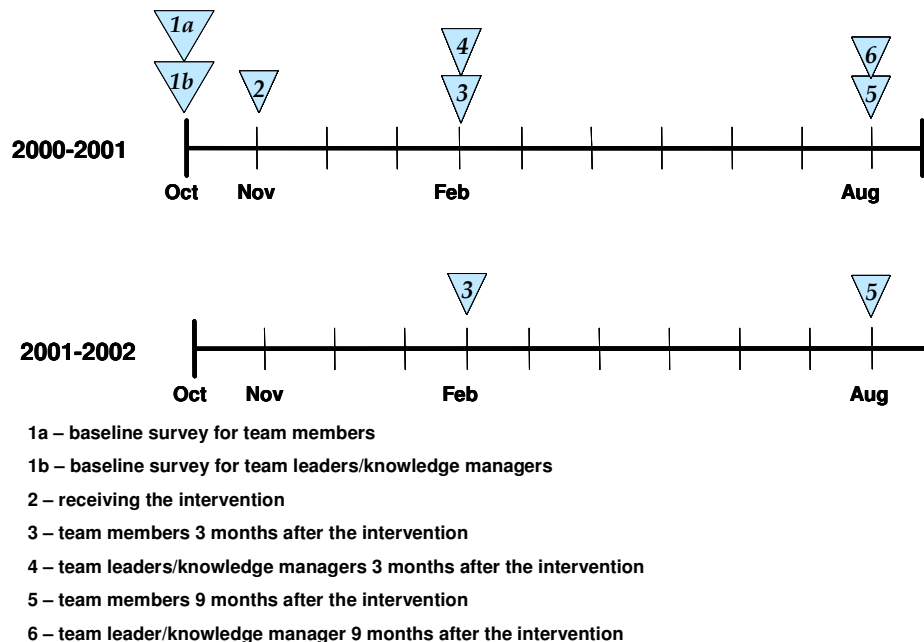


Figure 3.2. Revised planning of surveying baselines and students' opinions

Figure 3.2 indicates that following the first round of surveys it became evident that the original pace at which relative progress of competency building should be observed was not sustainable. In fact it was possible to obtain the baseline survey for team members and team leaders/knowledge managers only in the first academic year 2000/01. The intervention took place 1 month after the baseline survey and was followed by the survey of 3 months for both sets of population, and then finally 9 months yet again for both sets of the population. The evaluation of the 2000/01 survey results that follows, focuses on the periods after the baseline survey reviews were carried out. The majority of the argument is centered on 3 and 9 months survey comparison for team members and team leaders/knowledge managers. The scenario at the beginning of the second academic year 2001/02 was also altered by dropping the baseline surveys and focusing exclusively on the 3 month and 9 month survey comparison. The

experiment resulted in quite a number of recommendations used to create a better suited and simple survey, as outlined in chapter 5.

The preliminary findings of this research stem from the analysis of survey results. Conclusions are drawn by linking the qualitative outcome with project and individual marks of the students. Further research is needed to solidify evaluations and to be able to correlate in a statistically sound manner this and other interventions, and the subsequent behavior change brought about (see recommendations and proposed additional measures in chapter 5).

The translation, preparation, distribution, analysis, and synthesis of the surveys were undertaken under the supervision of the ETSEQ. Since filling out the surveys was a voluntary action (the survey was completely anonymous) it took quite some effort to encourage students to do extra work. Given this fact, the overall response rate was extremely high, above 90% on average. The surveys results are presented below in a graphical bar chart format illustrated in Figure 3.3.

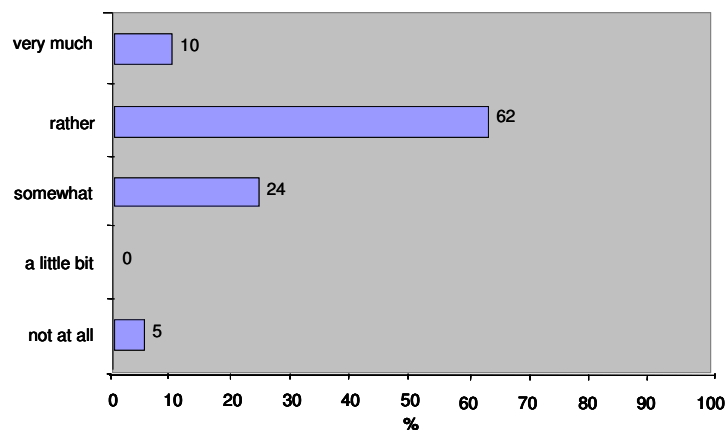


Figure 3.3. Example of the graphical representation of results

Figures 3.4 and 3.5 indicate the extent to which various questions had been answered by students in 2000/01 and 2001/02. As one can see from these two charts, the questions dealing with future solutions/comments/suggestions (questions number 2, 3, 4, 5, 32, and 39) were responded least by students. This is another indication that in ideal case scenario future surveys should not emphasize comments or reflective answers, but rather focus on multiple choice questions (see recommendations in chapter 5).

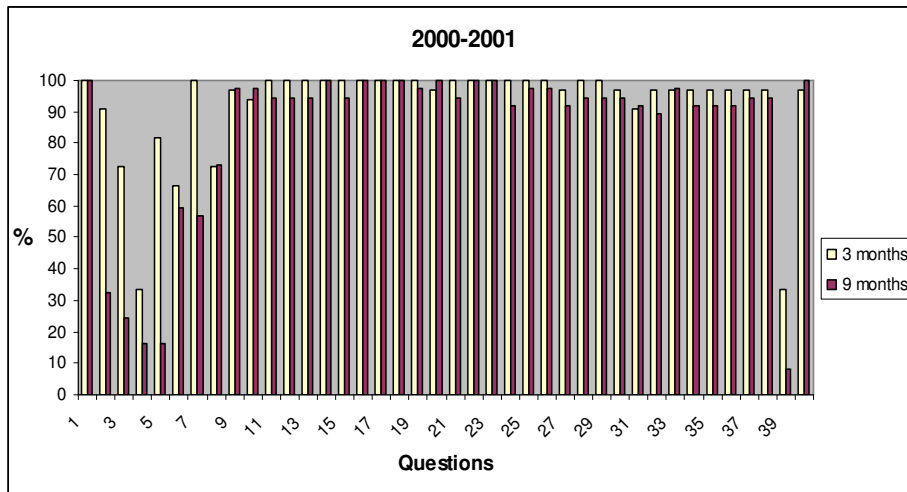


Figure 3.4. Survey questions answered in 2000/2001

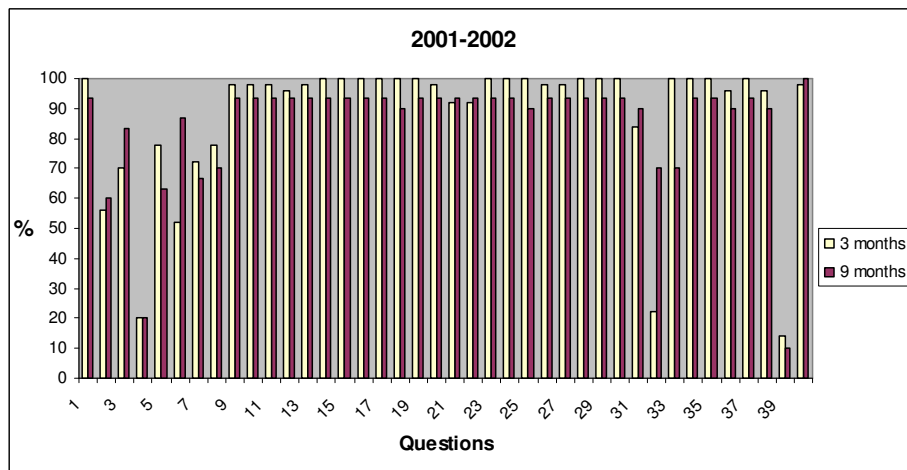


Figure 3.5. Survey questions answered in 2001/02

3.2 Evaluation of Surveys

3.2.1 Baseline Assessment in 2000/01

Previous experience of working in teams was limited in both sets of populations, team members (left graph) and team leaders/knowledge managers (right graph).

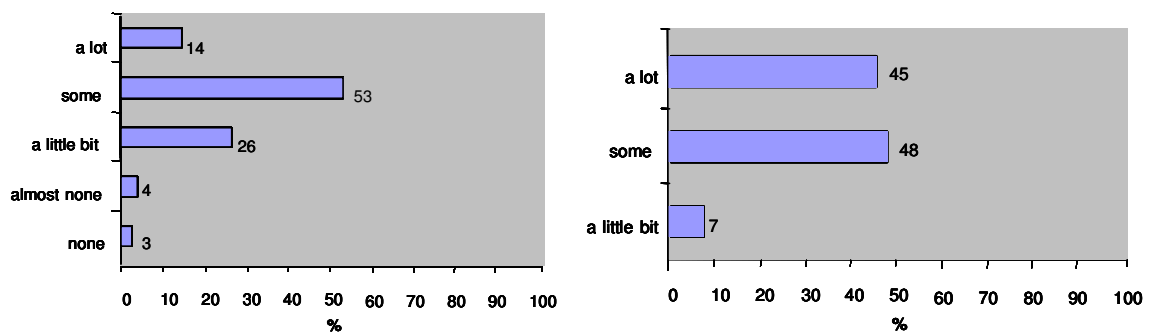


Figure 3.6. Experience of working in a team. Left - team members; right - leaders

It becomes apparent from Figure 3.6 that the integrated project was a true opportunity to practice teamwork in a more structured manner. Also, it is quite surprising that the majority of team leaders, who did have previous experience of working in a team in the 1st year projects, state that they only had some experience in working in a team. The reason for that is the de-motivation caused by the lack of well established IDP in 2nd and 3rd year of their studies.

The effects of the impact of the 1st year IDP on team leaders is clearly reflected in Figure 3.7. A large number of students, 74 of them, pointed out that they acquired experience of teamwork through the projects at university, while 27 did so at home or in team sport activities. It should be noted that in the academic year 2000/01 there were many students enrolled in the 4th year project practice course and, thus, 117 answered the survey. However, not all of them were involved in 1st year IDP teams, neither as leaders or knowledge managers. Other projects were set in place to accommodate this peak of participation in 4th year enrollment.

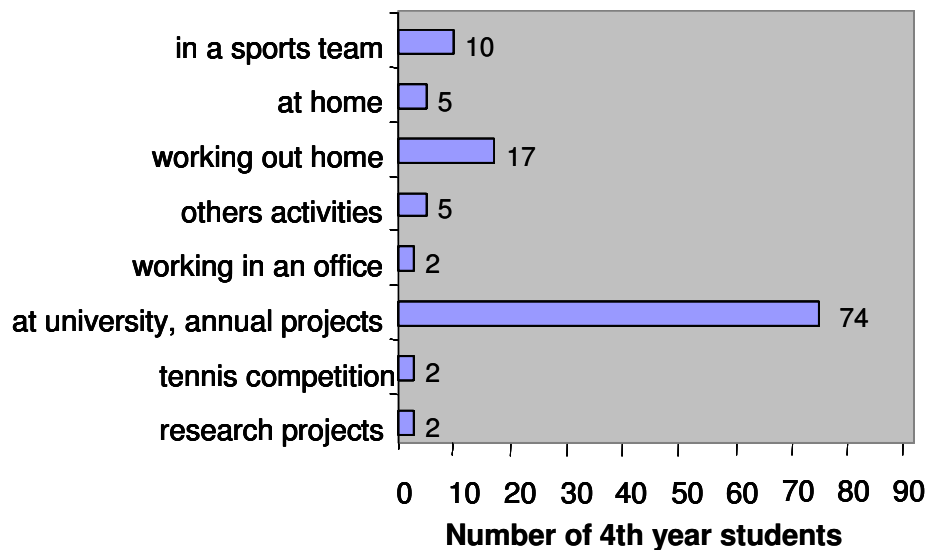


Figure 3.7. Experience of working in a team (leaders)

Team members manifested that in their pre university teamwork experience they found the greatest difficulty in the team capabilities (25%), followed by conflict resolution (18%), communication (13%) and performance evaluation (11%), as shown in Figure 3.8. When 4th year students were asked about the challenges of teamwork that they expected, there is a clear pattern in Figure 3.9 leaning towards conflict resolution (24%) and communication (21%), followed by team capabilities (17%), operating procedures (17%) and dealing with change (10%).

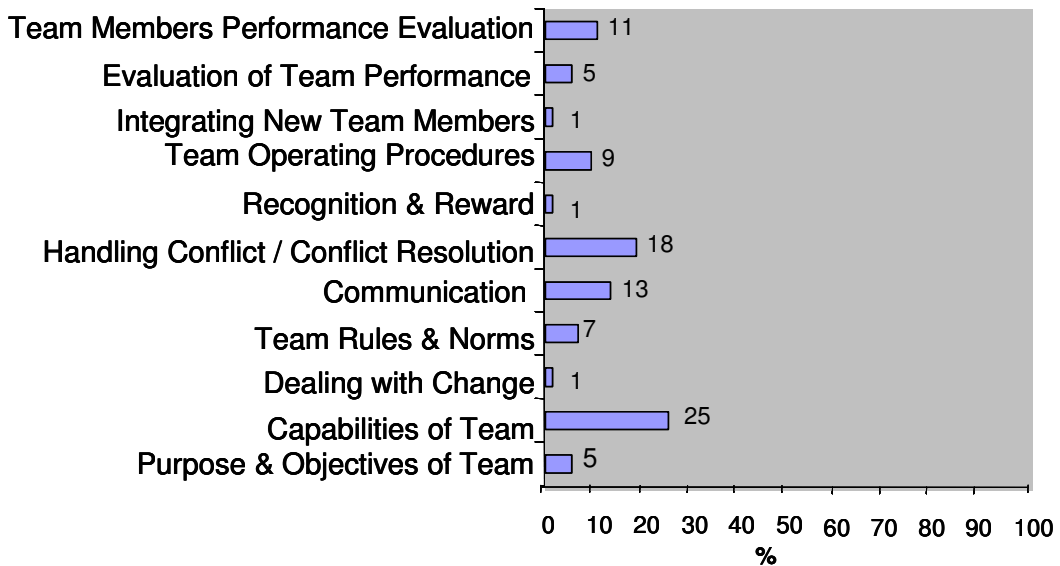


Figure 3.8. Areas of greatest difficulties expected by team members

Comparison of Figures 3.8 and 3.9 shows that team leaders and knowledge managers are more specific in identifying/forecasting problems/difficulties as 89% of them anticipate the above 5 areas of difficulty among the 11 options. A similar but more diffuse pattern is detected in the 1st year students. They seem to be more concerned about performance evaluation of team members, which is of no surprise given the individualistic approach of junior, high and baccalaureate education in Catalunya.

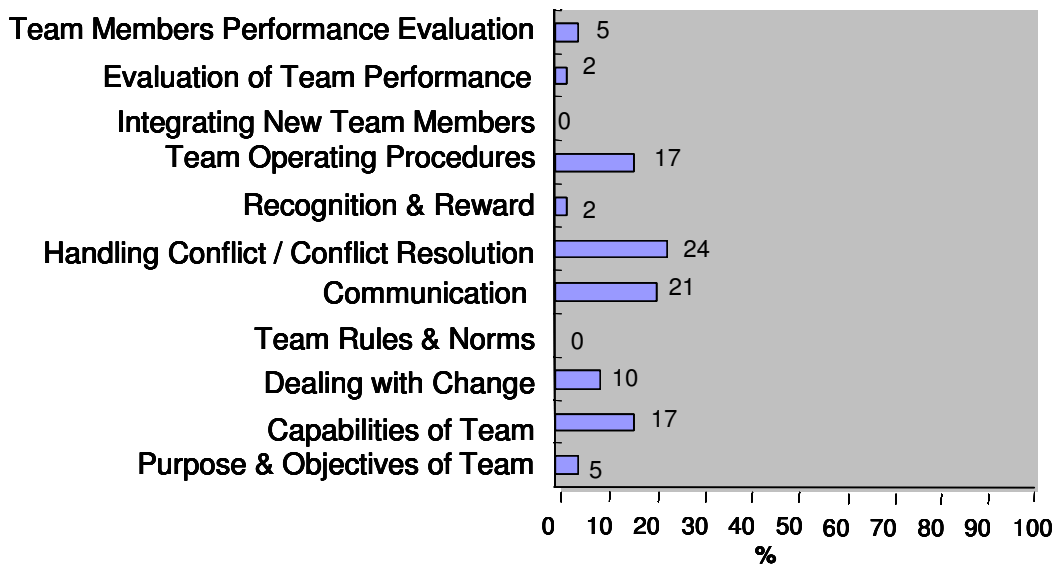


Figure 3.9. Anticipated areas of difficulty by team leaders/knowledge managers

Interestingly enough, there is quite a difference in replies when asked the preferred style of delivery to improve the competency set. Team members, to a large extent (80%) in Figure 3.10, prefer interactive and experiential learning, followed by coaching support. They had not yet experienced the effort required to build a team and to change from an individual centered working space to teamwork.

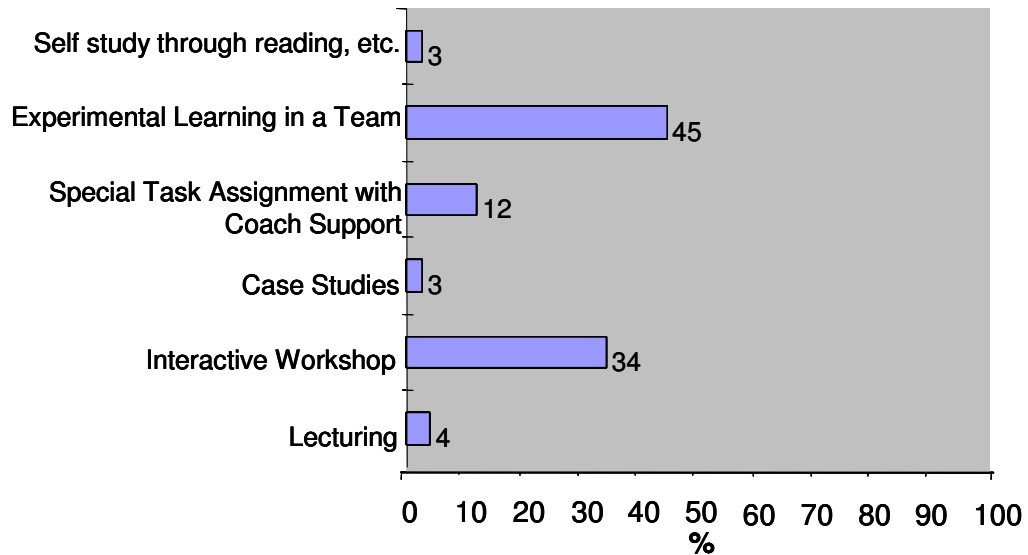


Figure 3.10. Training/learning method preferred by team members

To the contrary, team leaders and knowledge managers favor lecturing, followed by coaching in Figure 3.11. In informal discussions with 4th year students they manifested very clearly that they did not understand why they were asked to work in teams and in well defined/structured IDP, such as in the 1st and 4th year project scheme of Figure 1.4, if afterwards they had to return to conventional lecturing format in most of the academic activities of the 2nd and 3rd year of the chemical engineering program.

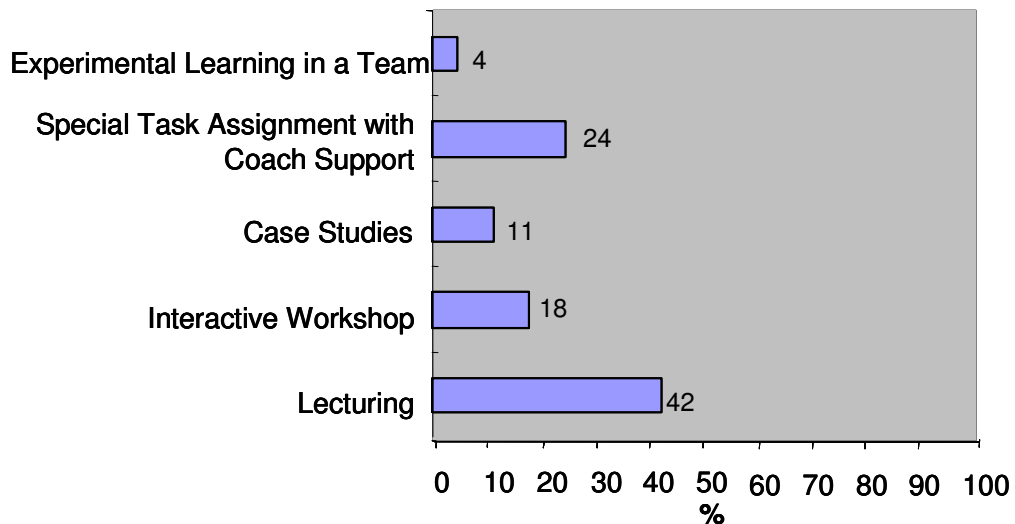


Figure 3.11. Training/learning methods preferred by team leaders/knowledge managers

The above results also correlate with empirical data [3] obtained by business organizations, like the Dow Chemical Company, stating that over time if not properly coached (see also recommendations in chapter 5), team leaders tend to lean towards a hierarchal role and forget how it feels to be on the “receiving end”.

When investigating further, the self perception of team leaders and knowledge managers is that of wanting to be creative and visionary, and leading by example,

as shown in Figure 3.12. They also want to have an informal and independent leadership style, as depicted in Figure 3.13.

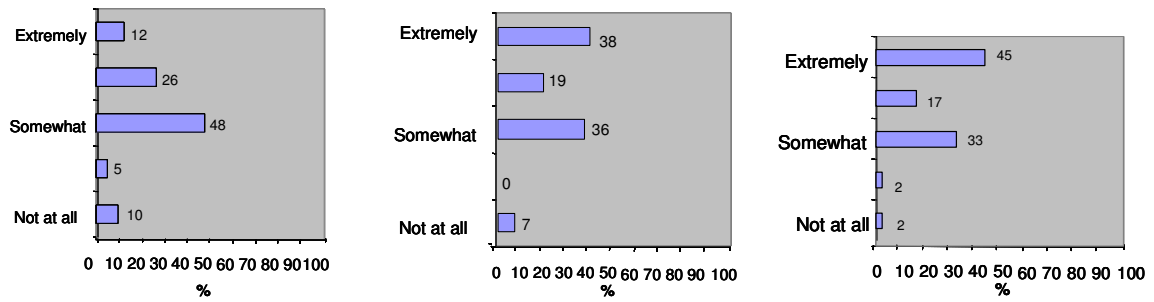


Figure 3.12. The perception of leaders and knowledge managers in regards to creativity, vision and capability of leading by example, respectively

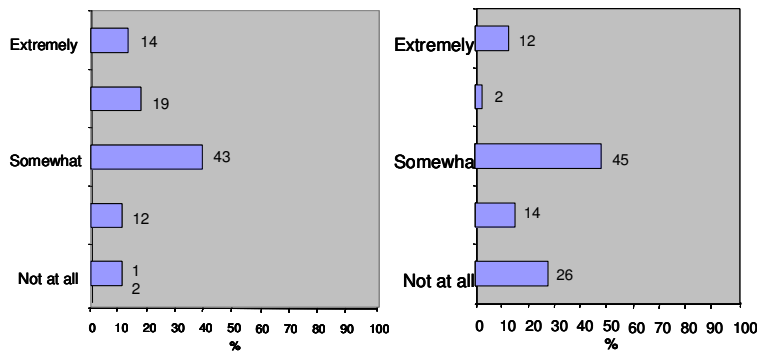


Figure 3.13. Perceived styles in team leaders and knowledge managers That same population of 4th year leaders and knowledge managers claims that their role should also be people oriented and driven by performance and reward, as respectively shown in Figure 3.14.

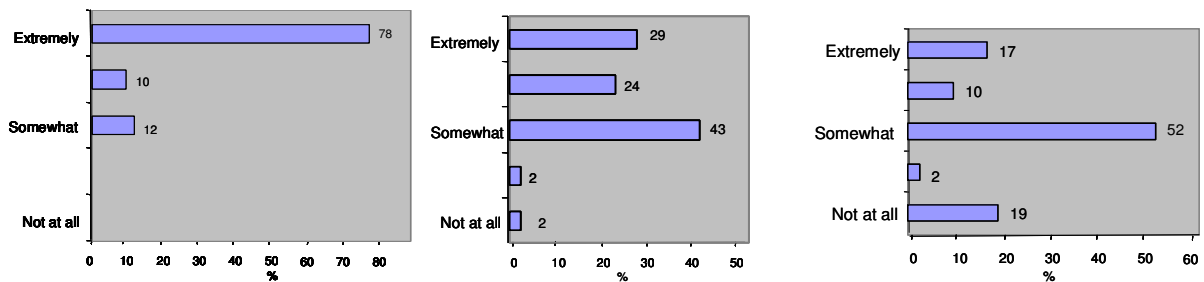


Figure 3.14. Perception of role orientation by 4th year students towards people, performance, and reward respectively

Again, these trends are congruent with other research data [4] on defining the role of a team leader. Research also supports certain characteristics and behaviors which increase team performance [5].

3.2.2 Survey 2 in 2000/01. Team Members after the Intervention

Survey number 2 was taken right after the delivery of the intervention “Enhancing Team Performance©”. As illustrated in figure 3.15, the overwhelming majority of participants perceived this intervention as rather helpful.

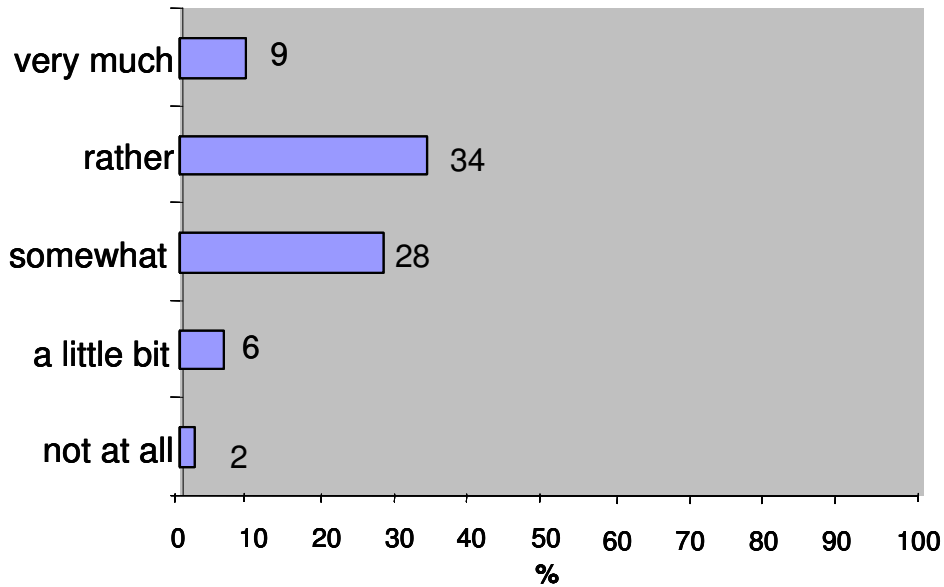


Figure 3.15. How helpful is “Enhancing Team Performance©”?

Communication and conflict resolution are confirmed again as two of the areas of higher concern since 43% of students think that “Communication and Conflict” is the most valuable module of the intervention, as shown in Figure 3.16. It will be seen later on (see chapter 5) that the positive correlation between handling conflicts and team effectiveness is proven again [6].

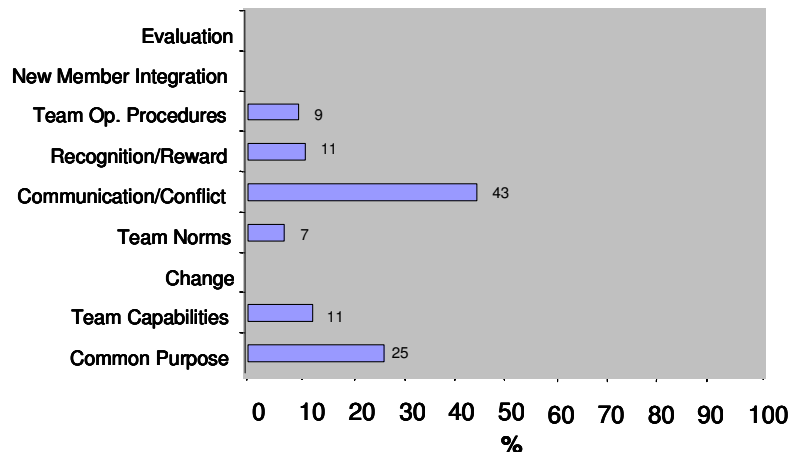


Figure 3.16. Rating of first most valuable module in “Enhancing Team Performance©”

In the list of priorities given in Figure 3.16 the module “Common Purpose” is ranked as number two (25%), followed at the same level by “Team Capabilities” and “Team Operating Procedures” (11%). The ratings in Figure 3.17 for the second most important module confirms “Common Purpose” while in third place appear “Team Operational Procedures”, “Common Purpose”, “Team Capabilities” and “Communication and Conflict” practically tied at about 18%.

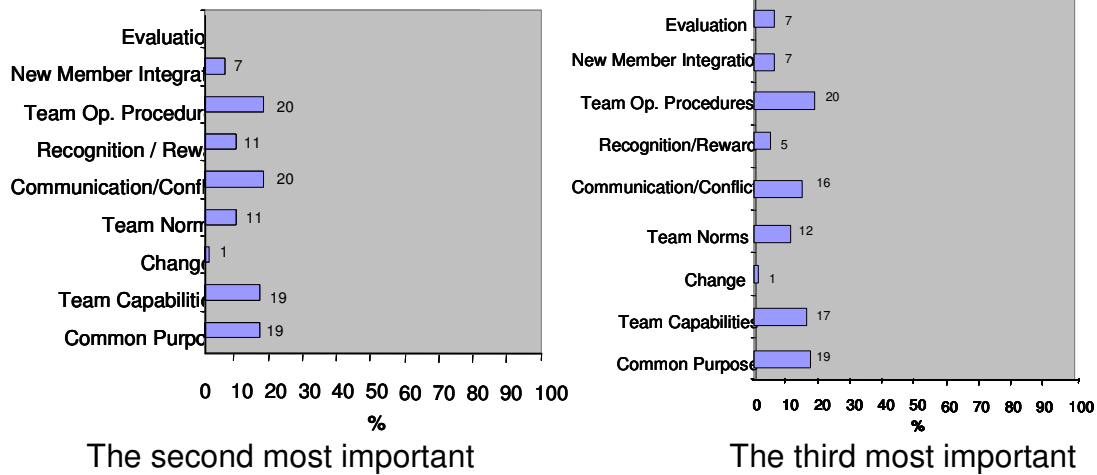


Figure 3.17. Ratings for the second and third most important modules in “Enhancing Team Performance©”

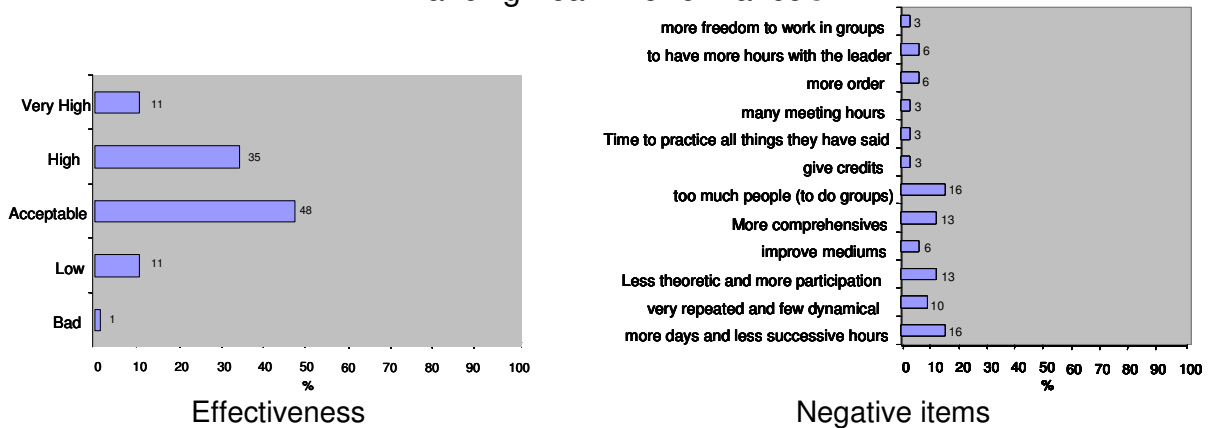


Figure 3.18. Effectiveness and suggestions for improving the delivery process. The effectiveness of the delivery of the intervention is rated on the high side, as shown in Figure 3.18. Once more, the above data correlates with similar research and confirms the pattern of key principles to enhance team effectiveness [7,8]. When it comes to effectiveness of delivery, the majority of recipients seem to be satisfied. However there are some areas for improvement, as listed also in Figure 3.18. Possible scenarios will be presented in chapter 5 on how to improve “Enhancing Team Performance©”, using the recommendations in this figure.

When asked about preferred working styles, it becomes clear that working in teams is not very common across the surveyed population, which reflects to a certain extent cultural patterns [9]. The results are shown in Figure 3.19.

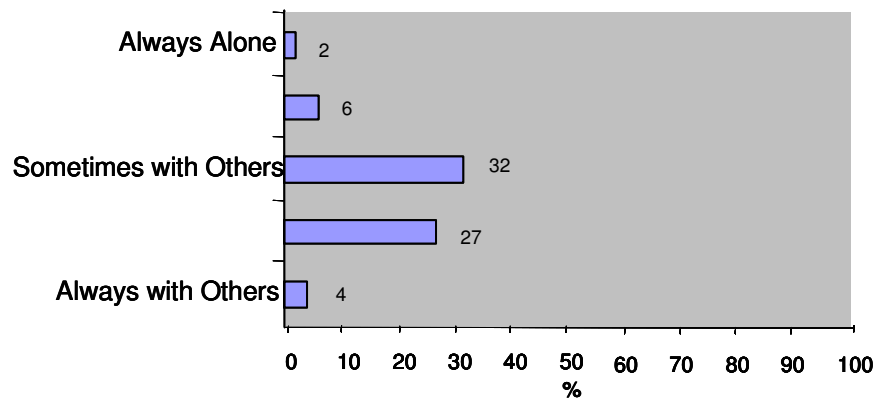


Figure 3.19. Preferred styles of peer interaction prior to university

3.2.3 Surveys 3 & 4 in 2000/01. Team Members 3 and 9 Months after the Intervention

Surveys 3 and 4 represent the core of the survey process, as here one can see progress instigated by the social intervention “Enhancing Team Performance©” and observe whether there are sustainable changes in behavior patterns.

Not surprisingly the module on “Communication and Conflict” is the most critical one, as has been confirmed by numerous other researches [6]. Moreover, the case is confirmed by the Dow organization experience [10]. It is apparent that the ability to communicate and to solve problems constructively are key competencies when driving team performance irrespective of whether it concerns a business or an academic environment, or any other social and collective environment. This is consistent with the current research hypothesis that team or group dynamics is a “basic human phenomenon” irrespective of environment. Indeed, there are cultural patterns which are impacting group phenomenon [9] but not the basic concepts. As a cultural issue, one could consider the increased need for operating procedures, a tribute that has to be linked to the Mediterranean work environment in which this research is operating [9].

When asked which module of the “Enhancing Team Performance©” training helped most the work so far, team members attribute initially high importance to the modules “Communication and Conflict”, “Common Purpose”, “Team Capabilities” and either “Team Norms” or “Team Operating Procedures”. The perception that these modules are very helpful increases over time, as indicated by the 9 months results in Figure 3.20. Similar trends were obtained when rating the second and third most helpful modules. The results in Figure 3.20 are consistent with research in this area [8].

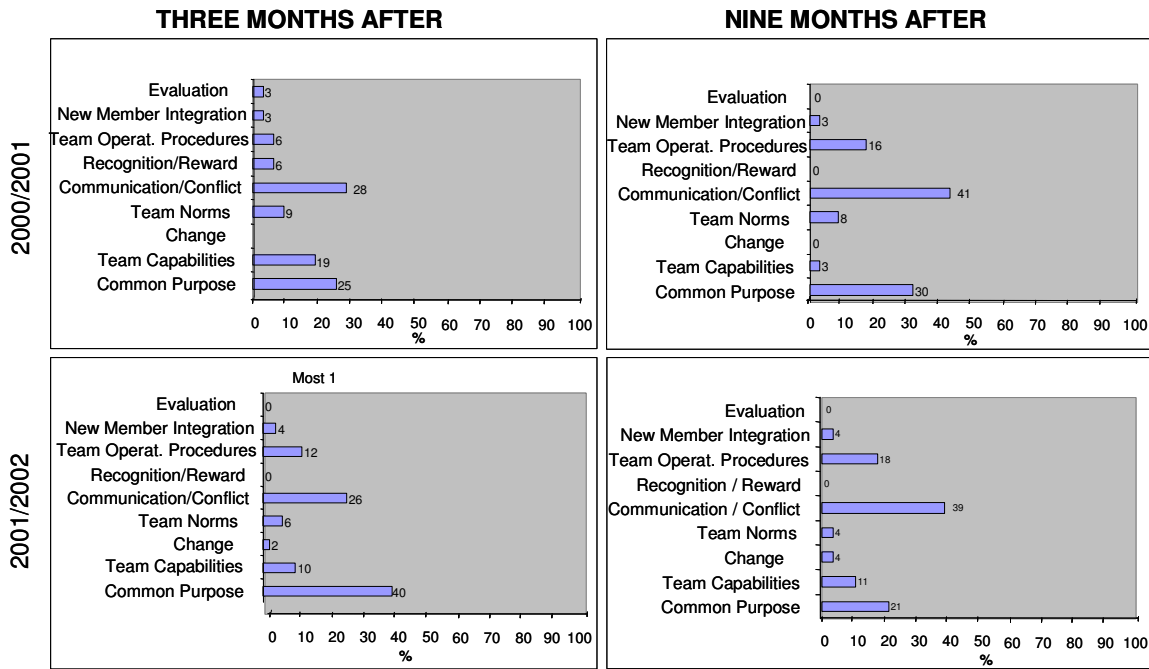


Figure 3.20. The most helpful module as rated by 1st year students

The answers in Figure 3.21 on how the most importantly ranked item from Figure 3.20 helped them, indicate that delivery of the social intervention clearly correlates with the ability to perform a certain task. In this case, the most important task is to finish the integrated project. It is noteworthy that after 9 months the students realize the critical nature of the project and the importance of social intervention in aiding the project performance. Consequently, time pressure forces collaboration and in a way, serves as an aid to a certain extent.

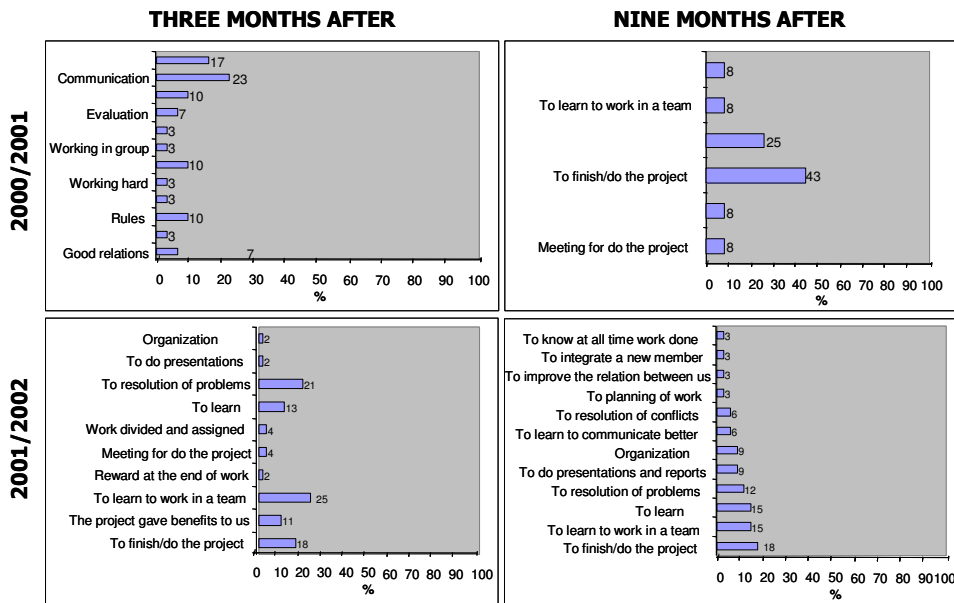


Figure 3.21. Specific examples on how helpful modules assisted students

When it comes to the students' need for additional help, Figure 3.22 shows that the majority would like to see more support when it comes to "difficult subjects". When asking students what that meant, they primarily look for additional knowledge (a task for the knowledge manager), and also for additional

competency building in this area. That would mean applying specific knowledge to the integrated project, and also expanding beyond traditional ways of studying, contrary to lecturing in a classroom (a task for the team leader). Over the surveying period, the need for additional help moves from generic declaration to more specific descriptions, akin to asking for more on “Communication and Conflict” to “improve the relationship between team members”. That in itself is a sign of an improved trust amongst the team and as a consequence, a qualitative indicator for the success of the social intervention.

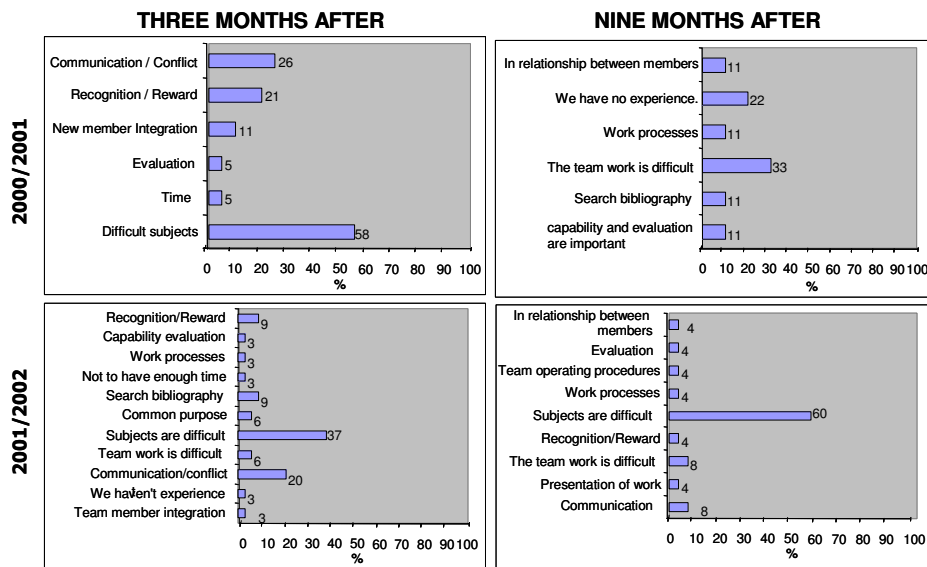


Figure 3.22. Areas in need of additional help

This is also supported by Figure 3.23 in form of the answers provided when asked for potential solutions.

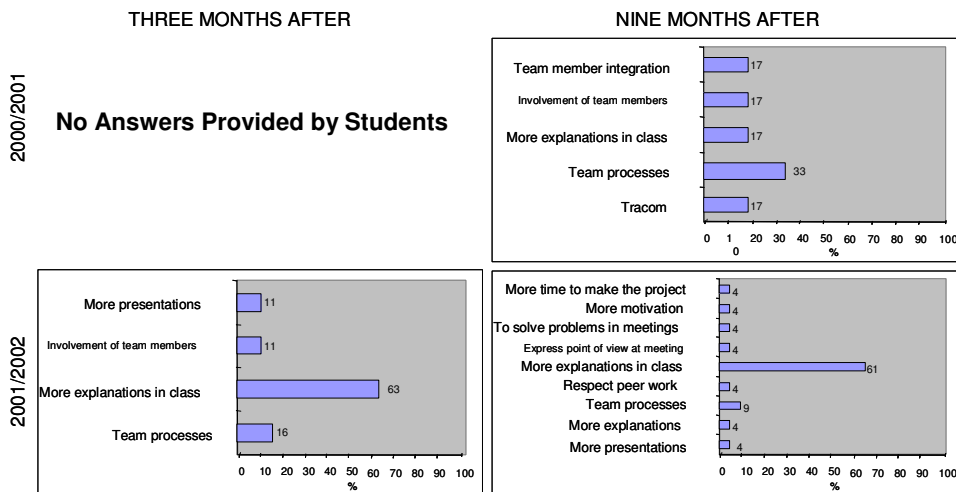


Figure 3.23. Potential solutions suggested by students

When asked where to put additional emphasis on education along the process, i.e., what issues do students think that were not yet covered, the students' answers in Figure 3.24 were very consistent with what was stated at the

beginning: Communication, Conflict and Team Capabilities. One can observe that Reward & Recognition shows up which also confirms that the teambuilding process is working as team members are thinking about how to reward and recognize each other [8].

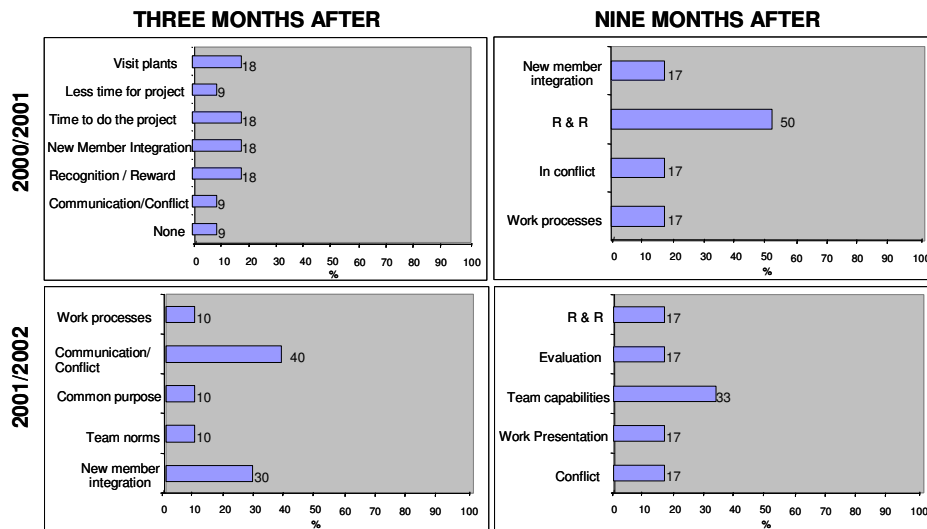


Figure 3.24. Uncovered issues where students need help

Figure 3.25 explores the students' work patterns when working as individuals. One can detect a shift in pattern when at the beginning of the studies, students were focused on reports and information search while at a later point in studies, problem solving and related issues become of greater importance.

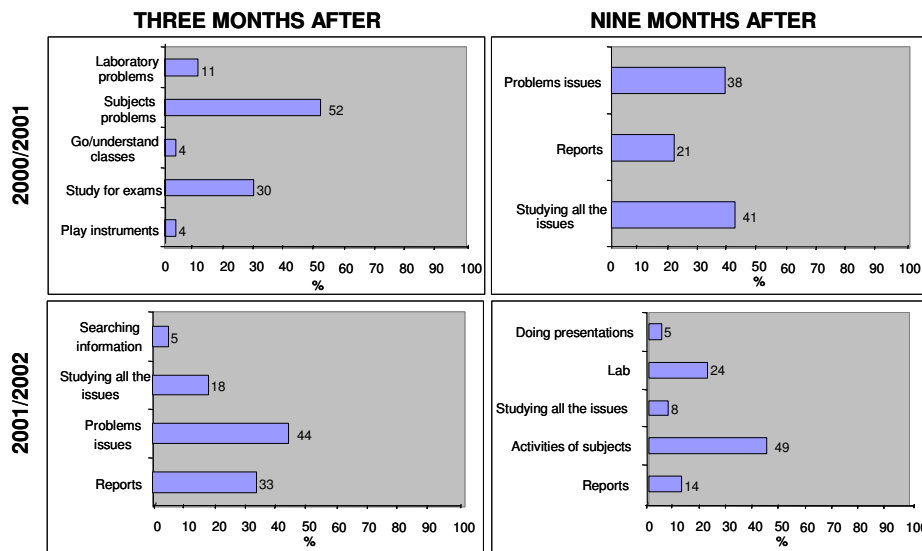


Figure 3.25. None team work related activities that students mention when asked to list two carried out on their own

Other research [10] supports this trend and confirms the students' increased awareness regarding evaluation as critical part of good project work. Students also mentioned that project, subject and laboratory activities are the three ones, where they had an explicit plan for expected tangible results. The impact of self evaluation remains inconclusive. While there is no obvious change in pattern

concerning the task of evaluation, one can detect a pattern change when it comes to ownership. Figure 3.26 indicates that students assume greater responsibility overtime, hence greater ownership of obtained results, which serves as clear indication of the progress towards the team building process [8]. The answers reported in Figure 3.26 were given when asked if the students' responsibility for results obtained had changed in respect to prior to university. A similar change in pattern with time was also observed when analyzing work planning activities.

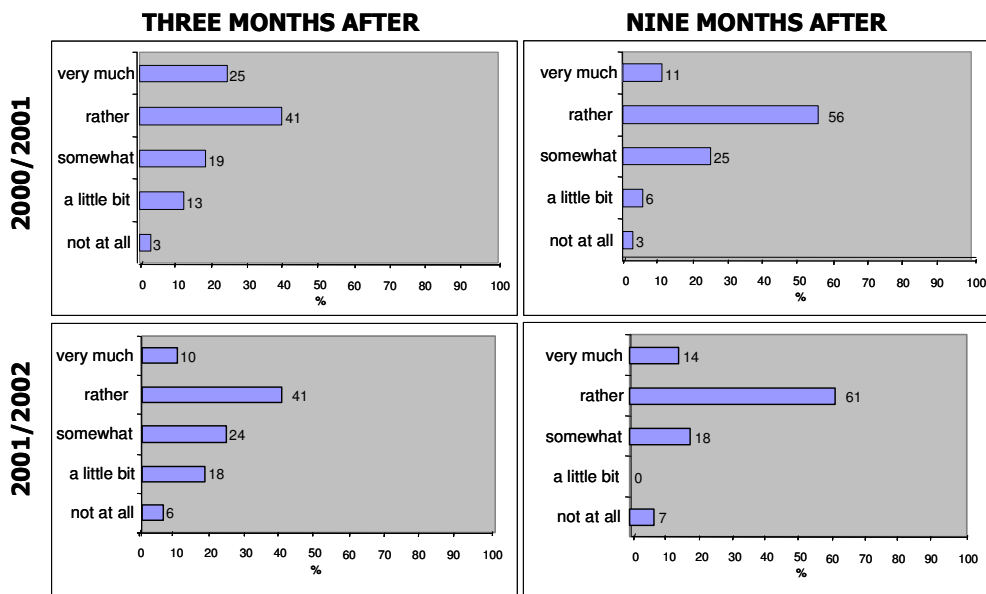


Figure 3.26. Shift of attitude towards ownership of results

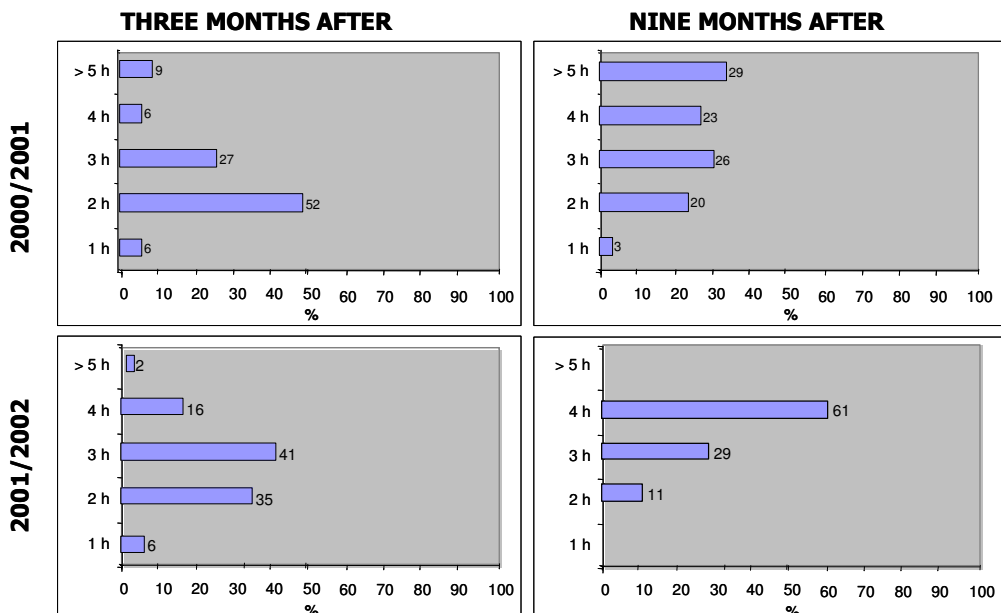


Figure 3.27. Interaction of team members with the team leader

The relationships within teams are analyzed in Figures 3.27-29. The weekly hours dedicated to meet with team leaders and knowledge managers increase significantly with time after the intervention, as shown in Figures 3.27 and 3,28.

While these are positive trends, they still represent an area for improvement. Apparently, as deadlines for the integrated project get closer, team members realize how much work still needs to be done and consequently call the leader for help. In the recommendations for future improvements (see chapter 5) measures are proposed on how member and leader interaction could be triggered much earlier. By doing so the team benefit would be increased, in addition the team would become more mature and consequently more sustainable in its performance. The same mechanics apply to interaction with the knowledge manager. Here, an earlier transfer of knowledge would be also desirable (see chapter 5). In conclusion, additional skill building for team leaders and knowledge managers is required.

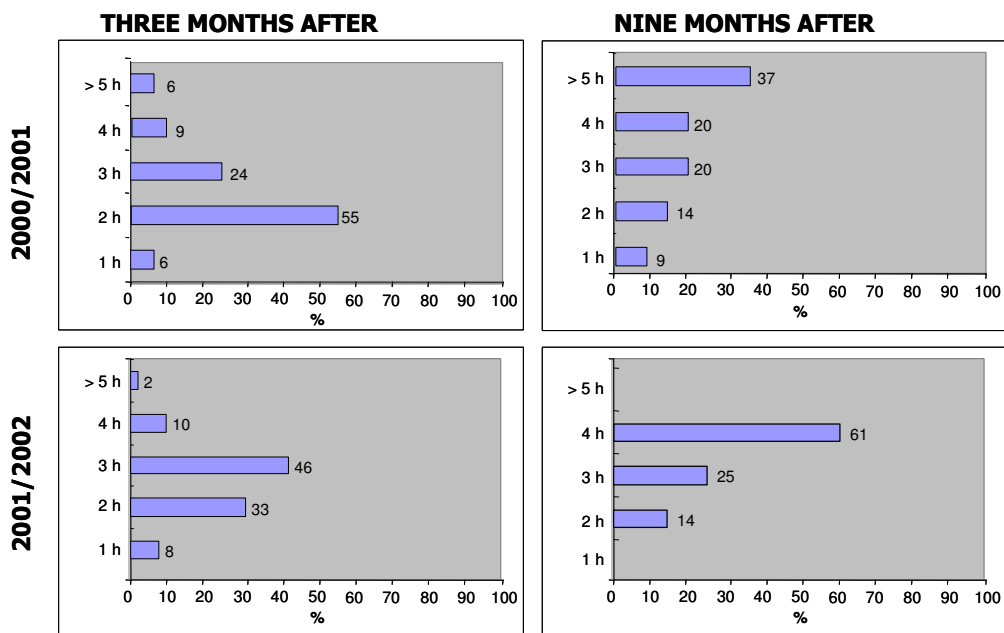


Figure 3.28. Interaction of team members with the knowledge manager

There is also a considerable increase in frequency of talking to peers, as depicted in Figure 3.29, but still more dialogue would be desirable. Perhaps roles between team leader, knowledge manager, and team members were not fully understood and consequently led to confusion and loss of productivity within the team. Again, this is addressed in chapter 5.

Naturally, the increase in time spent with peers shown in Figure 3.29 translates into more team meeting time. Results not presented here also show a corresponding increase in the percentage of the total time of team meetings that is dedicated to discussions with peers. The significant shift towards more than 5 hours per week spent in meetings with peers observed in Figure 3.29 indicates that teams are moving from a leader directed to a leader centered one (see also Figure 4.1). “Enhancing Team Performance©,” which aims at this change, is a robust learning resource, since it drives improvement despite occasional absence of “management support” represented by non coaching professors. The difficulty will be further addressed as an area for improvement in chapter 5.

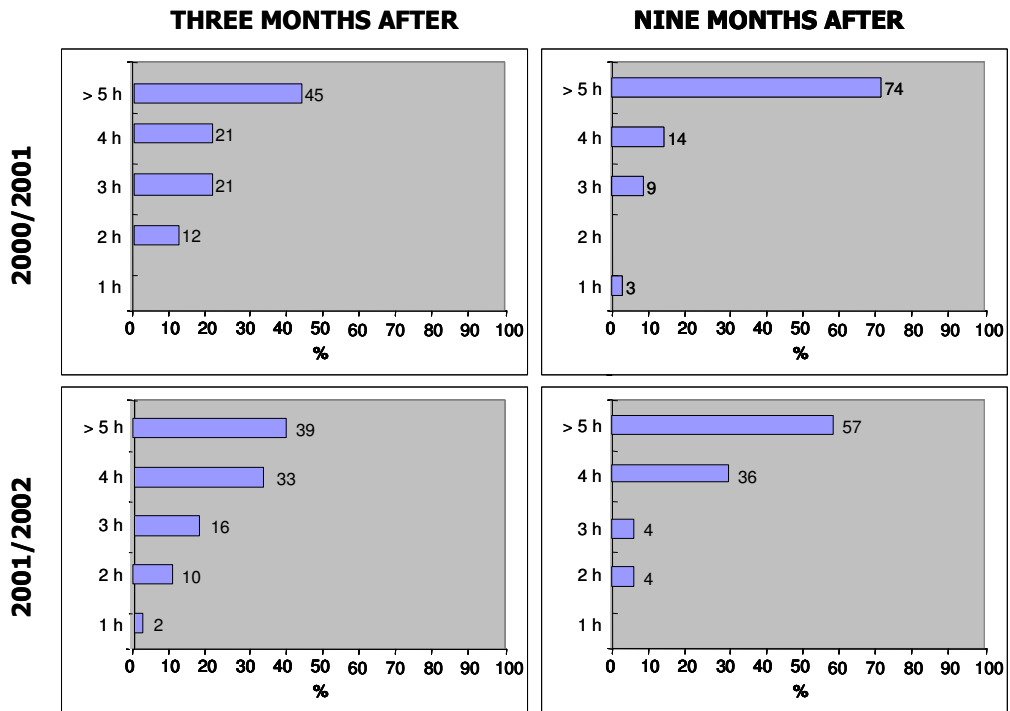


Figure 3.29. Frequency of peer interaction

In responses to question on percentages of total time allocated to team meetings that were dedicated to scientific or technical discussions, summarized in Figure 3.30, one can notice an increase in the intensity of discussing scientific or technical matters as the deadline for the integrated project gets closer. The fulfillment of deadlines precipitates discussions and the decision making process for the final report and poster.

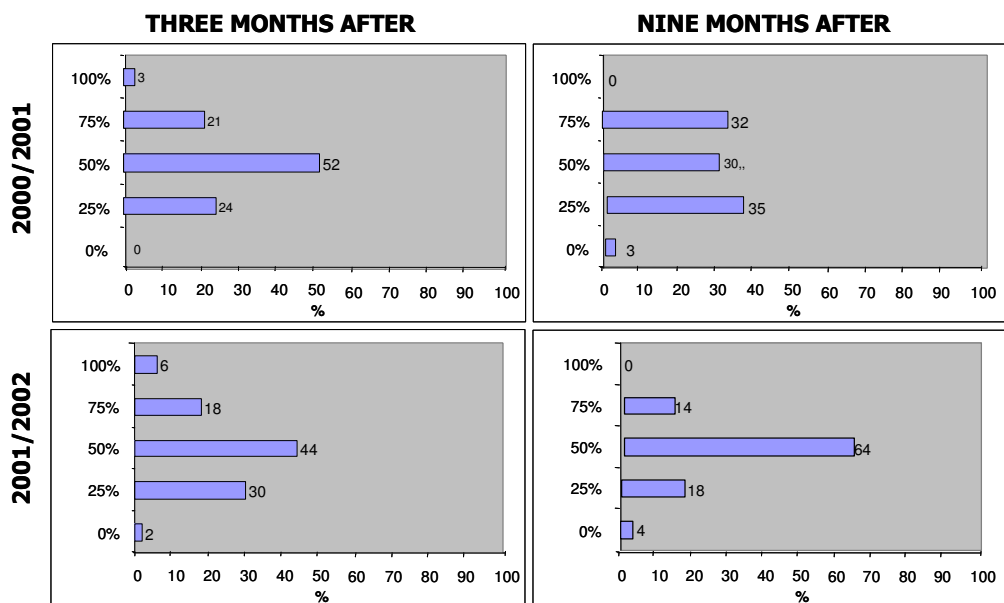


Figure 3.30. Team meeting time dedicated to discuss scientific and technical matters

As one would expect from a good team building process, both team members and their leader recognize the need to spend an appropriate amount of time

discussing issues related to their team in order to build productive “team hygiene” [8]. Results not shown here indicate that the time dedicated by teams to discuss organizational matters remains unchanged at about 25% of the total time allocated to team meetings during the IDP period.

While there is a considerable and sustainable change in team patterns, no change in individual patterns has been detected, as highlighted in Figure 3.31 for the particular attitudinal aspect of listening or talking in meetings. At a first glance, the results in this figure appear to be logical, as “Enhancing Team Performance©” is primarily an intervention focused on team behavior and not so much on individual behavior. Individual behavior can be ultimately changed only when working with a team and under leadership over an extended period of time [8,11]. Individual learning is further addressed in the areas for future improvement (see chapter 5), since reflection of team patterns on the individual is critical and should result in greater individual learning than that reflected in Figure 3.31. As a preview, it can be concluded that it takes work on individual, team and organizational level to change behavior in a significant and sustainable way.

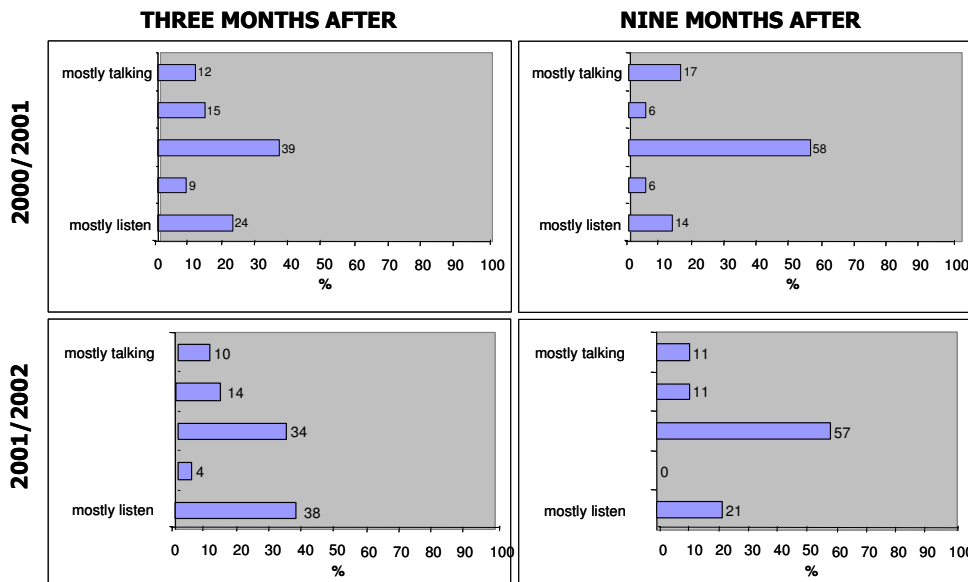


Figure 3.31. Example of team members’ evolution in respect to individual behavior change during team meetings

Other responses not presented here showed that no significant change in the way participants attempt to contribute to the purpose of the team is detectable over time. This fact could lead to the conclusion that the principles of effective teamwork are not fully engrained. Based on theory and research [8] one would expect an eventual reduction in the effort needed to discuss the purpose of the team. This is because the purpose of the team has become fully evident and is accepted by all team members. This pattern also seemed to be true for the contribution of team members to planning and realization of projects by teams. Nevertheless, a positive change in behavior was observed with respect to the evaluation of causes for success or failure in teamwork. Participants were much more engaged in follow-up and analysis of results after the intervention and as project deadline got nearer.

Figure 3.32 elaborates on the activities taking place between team leader and the team. It is apparent that resolving conflicts and communication are the key issues. Therefore team leaders should transform their role towards coaching, as team members clearly need help in this direction (see paper in Appendix A).

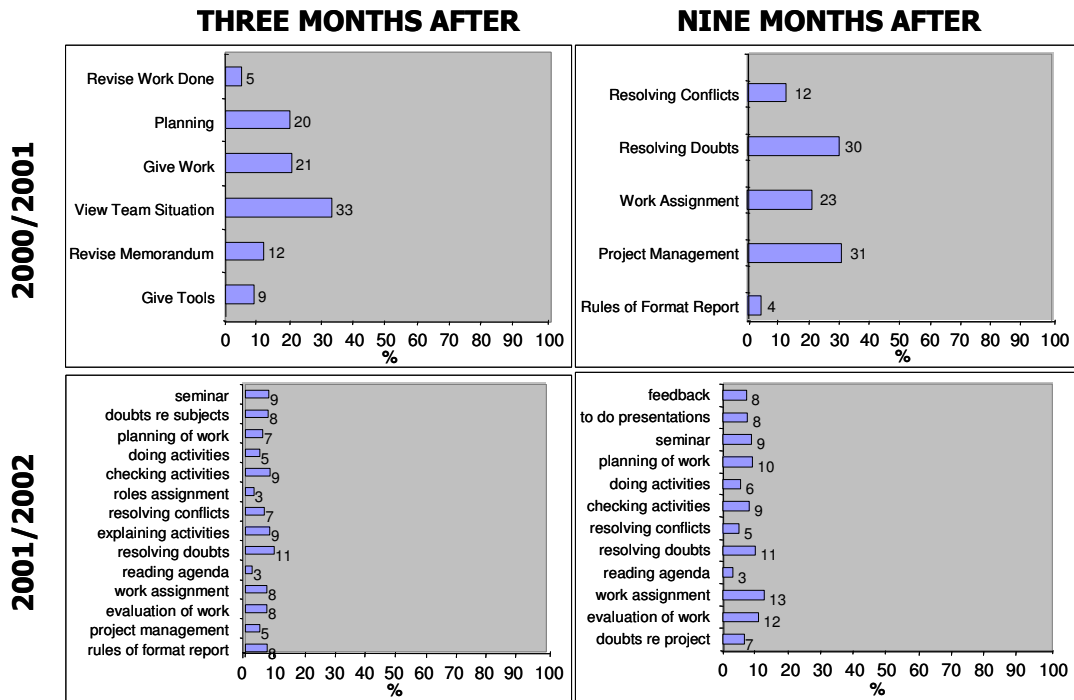


Figure 3.32. Most relevant activities carried out by team members with team leaders

The pattern in Figure 3.32 was also applicable to the knowledge manager, reconfirming that conflict resolution and question clarification are crucial elements of the project. The above findings are equivalent to the industrial work place. The business model organization for this research, The Dow Chemical Company, has a “social coach” and a “work process coach” (or technical coach). Both roles are absolutely vital to developing team skills and translating them into team performance [12]. Here the congruency between the academic organization and the business organization is very consistent. It can be stated, that irrespective of the nature of organization, social skills are best introduced when integrated as part of a process over at least a six months period with consistent coaching and support (enabling infrastructure) in place [13]. Besides the above mentioned recommendation (see chapter 5) a better structured dialogue among team members regarding role clarity is recommended. Despite role clarification being an important issue during any change in work pattern, it is still not adequately addressed in general [14]. In addition, there is too much focus on lecturing, which is consistent with the preferred style of teaching by team leaders and knowledge managers. Earlier in this chapter it has been referenced that this represents a conflict with the preference of the team.

Replies in Figure 3.33 concerning individual responsibility for work assignments, demonstrate high commitment to project work to begin with. That commitment increases somewhat overtime - yet not as much as desired. This represents an area for improvement, in form of a follow up intervention for the team as well as

additional education for team leader and knowledge manager to enhance their coaching skills (see chapter 5).

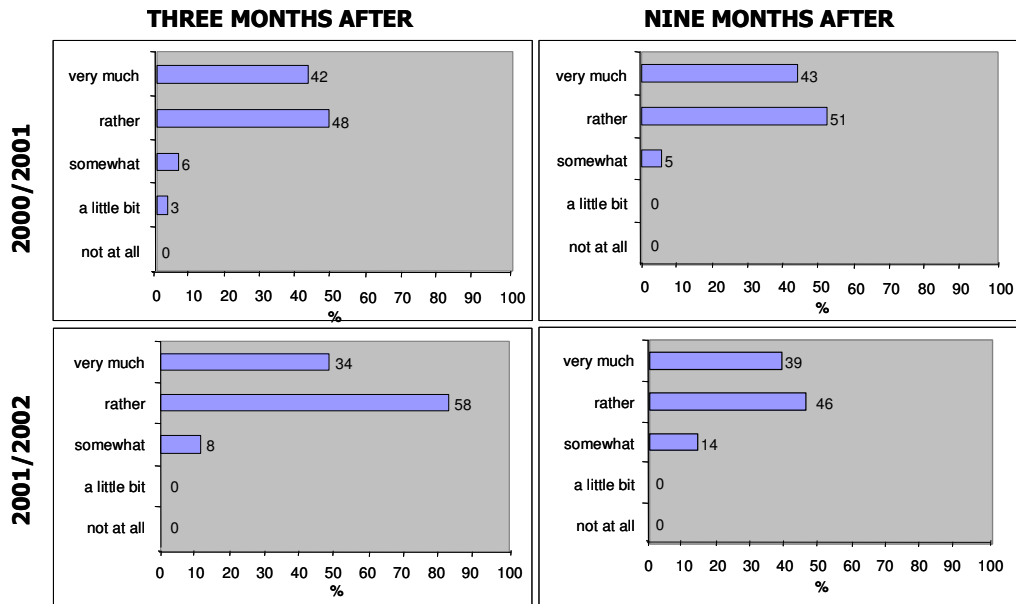


Figure 3.33. Commitment to project work in respect to work assigned to each team member by the team

The initial high commitment was also manifested by the fact that students hardly ever missed classes or team meetings. Also, there was an over time decrease in missing a team project deadline. Improved team skills and commitment to the team could be a possible explanation for this behavior.

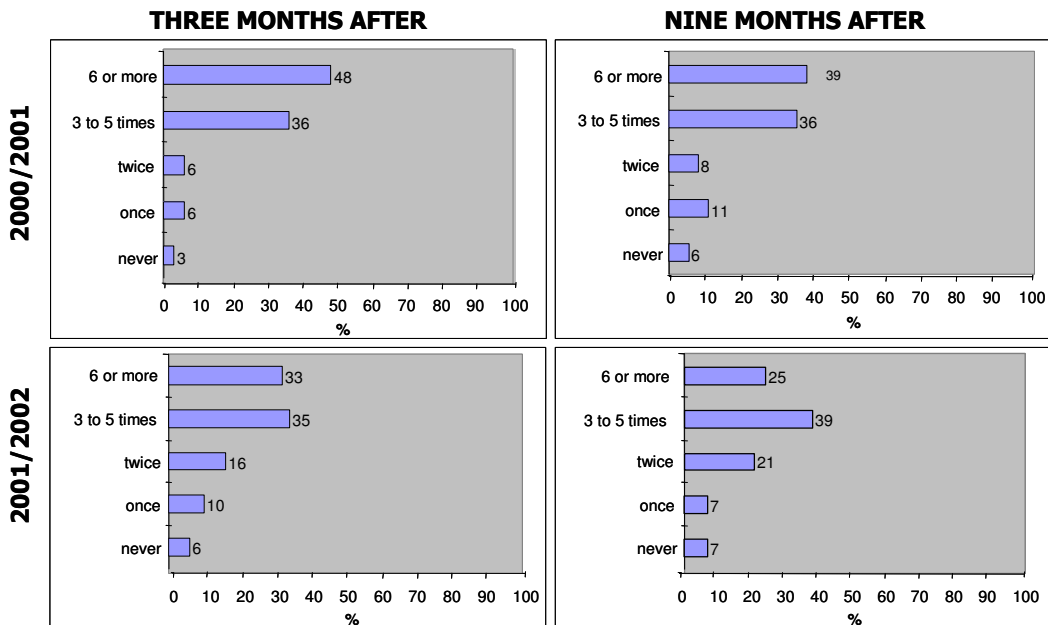


Figure 3.34. The frequency of peers helping their team members

The frequency of interaction between peers and the support they give to each other seems to be pretty constant over time in Figure 3.34. The high level of collaboration could potentially be attributed to the cultural pattern in this part of

the world [9]. Other questions on collaboration among team members confirmed a positive shift towards an increase in collaboration - an ingredient for team success. With respect to the opportunity to 'cross fertilize' by learning from each other, results showed that learning from peers still represented an area for improvement, as collaboration and sharing amongst team members has not yet reached its optimal level. It is acknowledged by various sources of research [15] that learning, sharing, and building on each other's knowledge amongst adults is difficult. This phenomenon is addressed in chapter 5 with recommendations for future improvements put forward.

When team members were asked how much they had learned from the discussions and interaction with the knowledge manager, they responded that the role of knowledge manager is a very helpful and an effective one, as summarized in Figure 3.35. One could speculate that at the beginning of the project a number of team members had already identified the knowledge manager as a source of information. Over time, more team members realize the value of the knowledge manager and apparently use this learning resource effectively. Despite that, the full potential of the knowledge manager role is not yet exhausted.

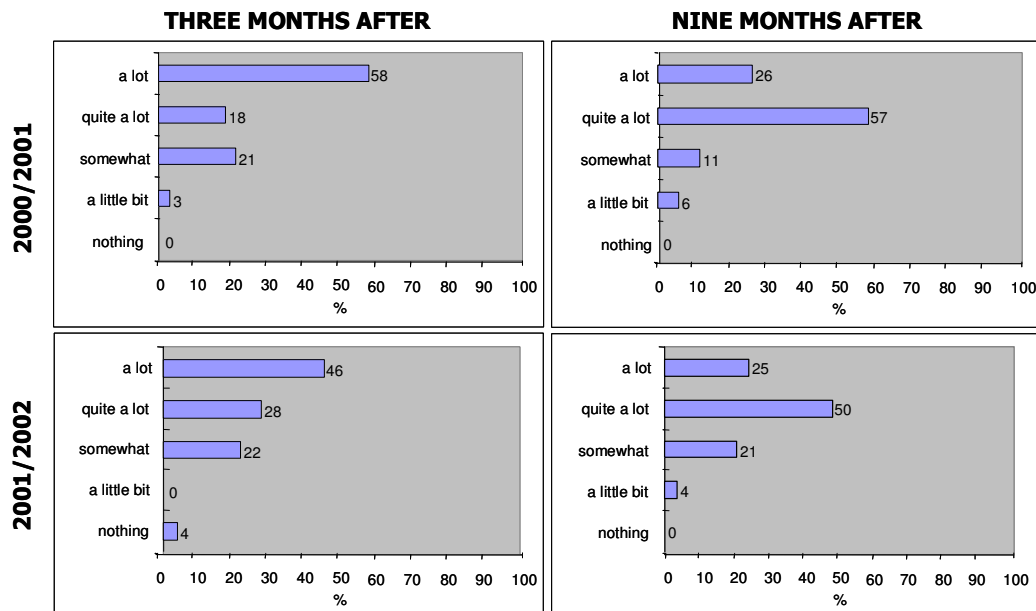


Figure 3.35. The role of the knowledge manager in each team

The fact that the potential of the knowledge manager role can still be enhanced is shown by the pattern in Figure 3.36, which illustrates that the resources outside of one's team (team members and knowledge managers from other teams) have not been utilized by a significant portion of the surveyed population. A majority of team members rarely interact with other teams in search for information or to establish partnerships.

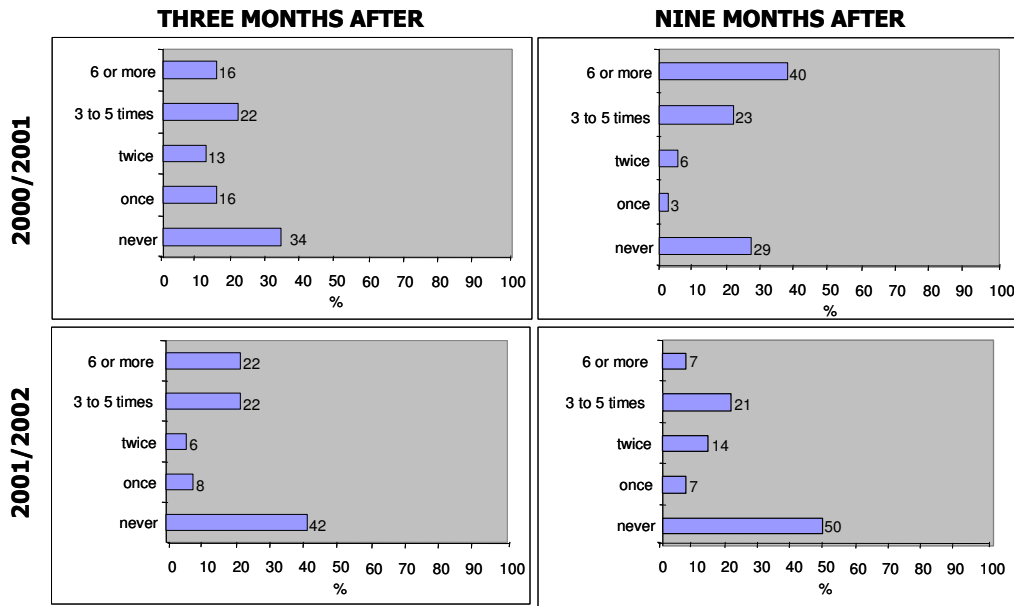


Figure 3.36. Cross team communication and interaction

Role rotation between team members is examined in figure 3.37. The test confirms that role change on a rotating basis is difficult to accomplish both within an academic and a business organization environment [16]. At the ETSEQ the number of rotations does not seem to increase with time after the intervention, remaining at about 80% and 60% for two or more rotations in 2000/01 and 2001/02, respectively.

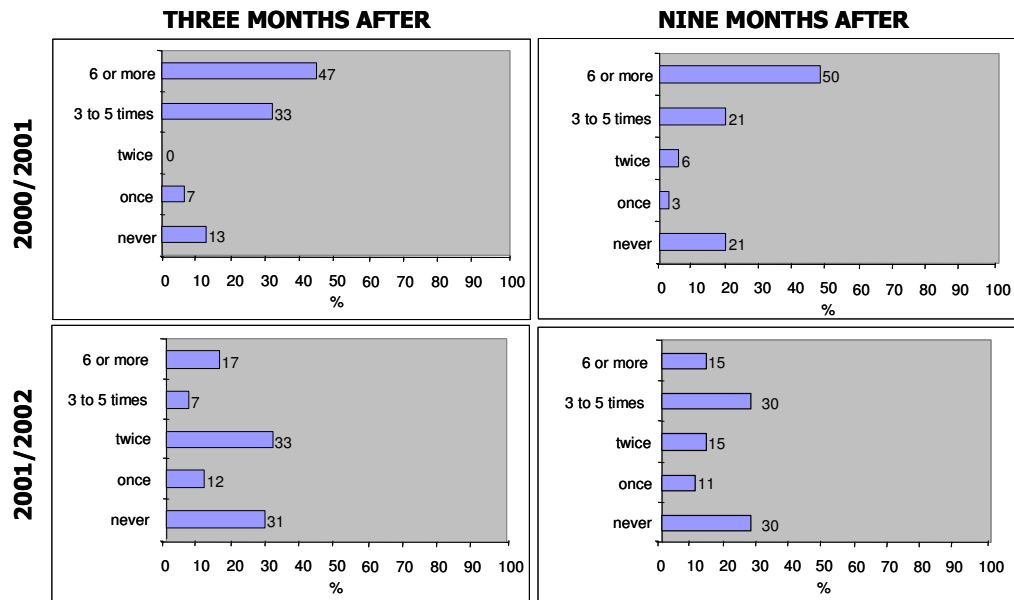


Figure 3.37. Frequency of role rotation within a team

Research has stressed the fact that self evaluation is vital for cognitive reflection and changes in behavior towards higher levels of performance [17]. In this connection it is pleasing to note in Figure 3.38 that qualitative or quantitative self evaluation of students' own work increases with time after the intervention.

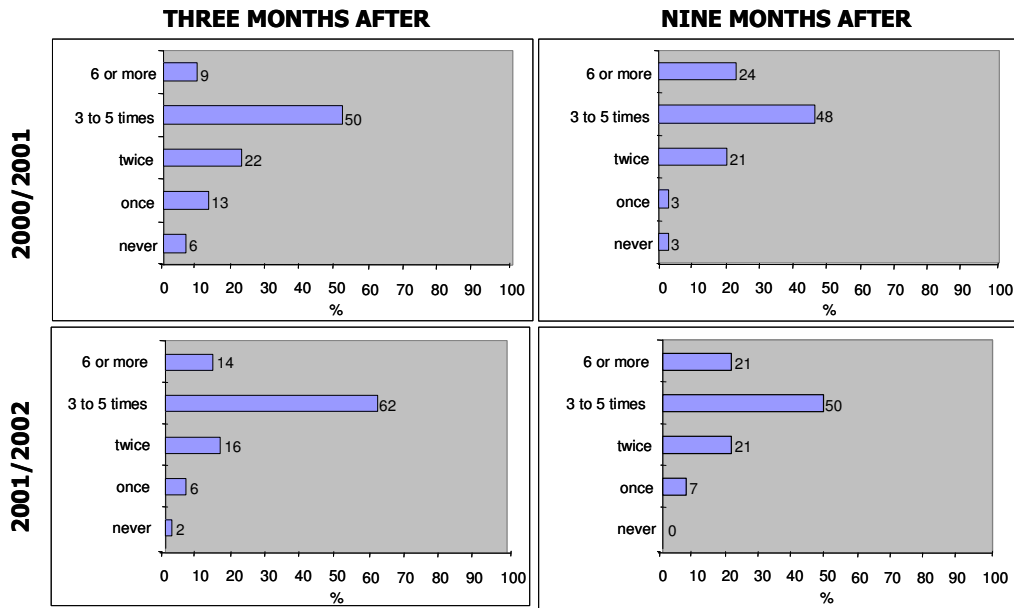


Figure 3.38. Number of qualitative or quantitative evaluations of one's own work carried out over 3 month period. Related to the 1st and 4th year IDP

The positive trend of increased self evaluation in Figure 3.38 is confirmed in Figure 3.39 in responses to the question: how many times have you qualitatively or quantitatively evaluated the work of the other team members during the past 3 months concerning the 1st and 4th year IDP? A significant pattern change towards evaluation of other team members has taken place according to Figure 3.39. This could be interpreted as a sign of increased trust among team members.

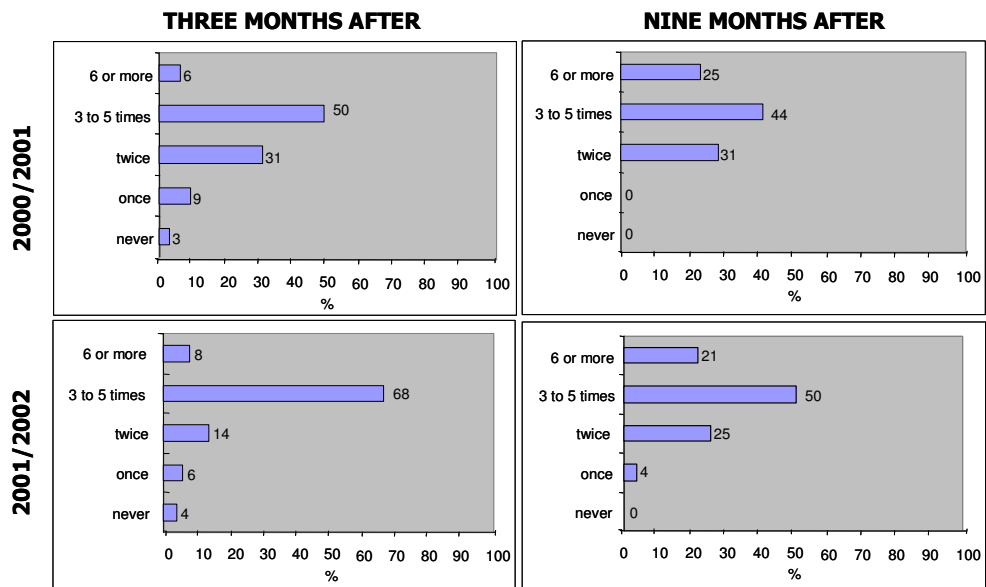


Figure 3.39. Number of qualitative or quantitative evaluations of peer work carried out over 3 month period. Related to the 1st and 4th year IDP

As observed in Figure 3.40 from the responses to question: how many times have you evaluated the team leader during the past 3 months, team leader evaluation takes place much more frequently as the project moves forward. These

encouraging results also indicate that with more coaching skills in place (see Appendix A) the improvement in evaluation could be increased further.

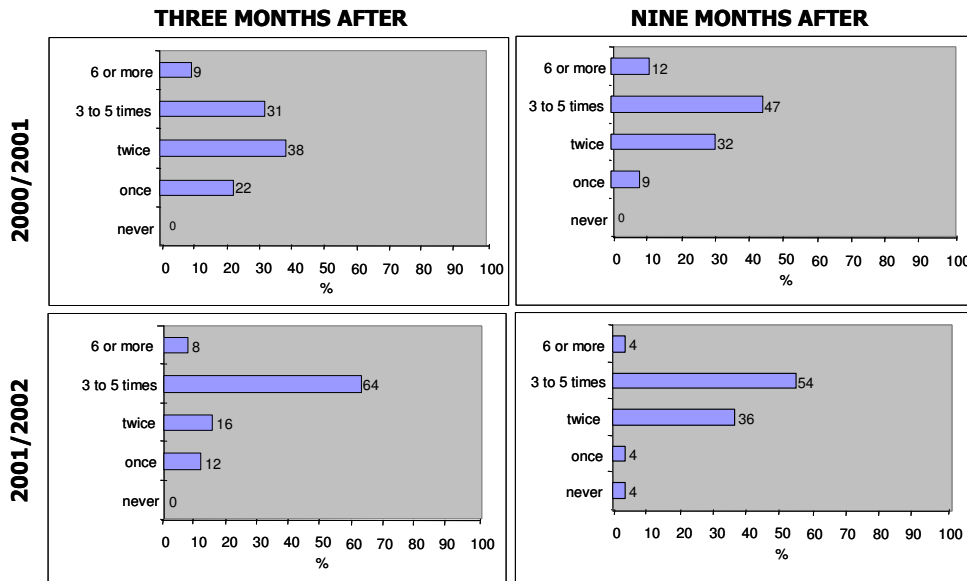


Figure 3.40. Number of qualitative or quantitative evaluations of team leaders by team members carried out over the 3 month period. Related to the 1st and 4th year IDP

Similar positive trends were observed in the area of evaluating the role of knowledge managers, as well as in the recording and analysis of deviations of completed work. Also, the surveys confirmed a definite advance in the area of collaboration, i.e. sharing increases with project development.

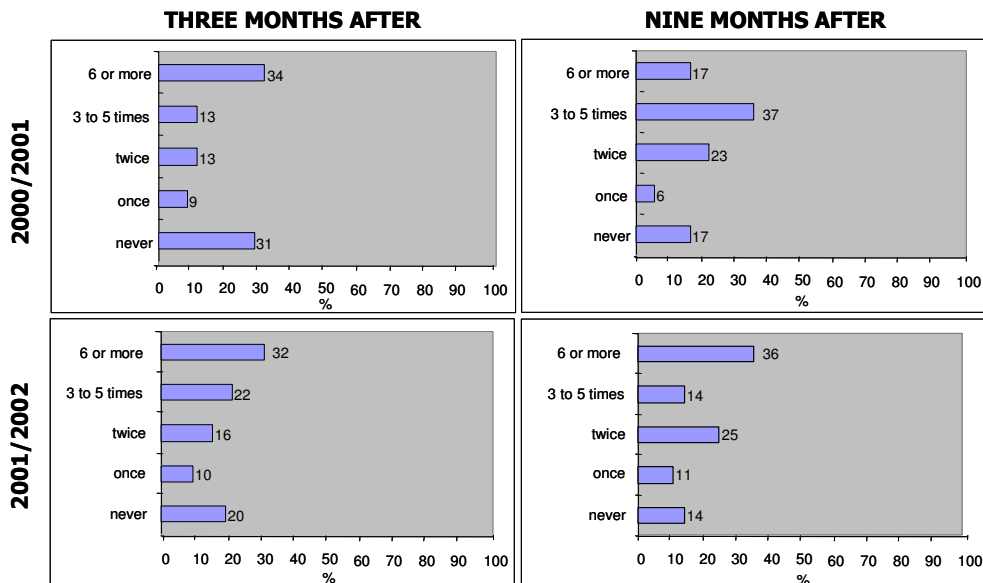


Figure 3.41. Peer work review

Figure 3.41 shows that the number of times that team members were asked to review and check the work performed by a peer increases significantly with time. In general, team cohesiveness improves along the project and there is a growing understanding that the level of interdependence and the level of shared

responsibility for results are ever higher [7]. This is clearly reflected in Figure 3.42, where most students state that they very much perceive the project teamwork as an “all float or all sink” situation.

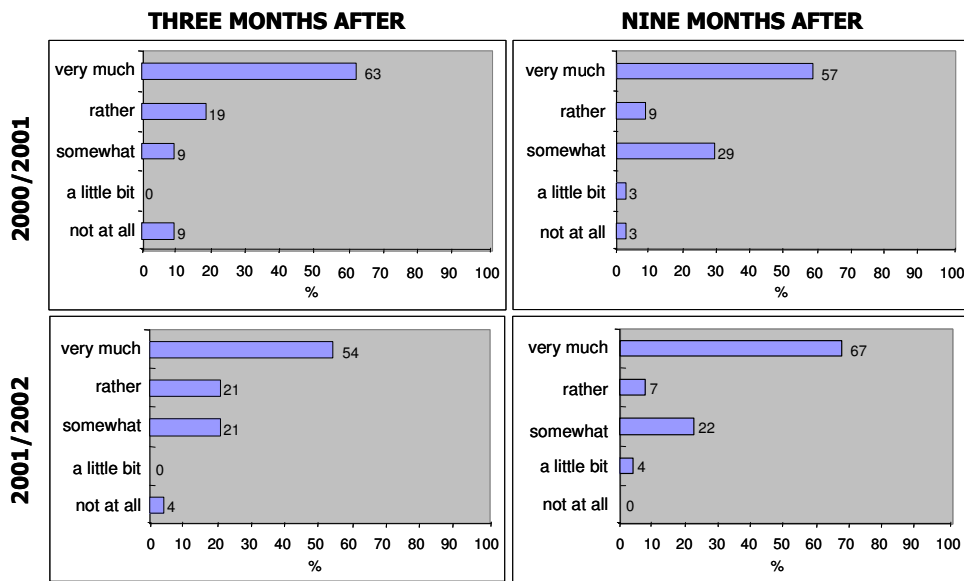


Figure 3.42. Interdependence within a team in terms of students’ perception of teamwork as an “all float or all sink” situation

Feedback comments obtained from the surveyed population can be clustered as follows:

- Better explanation of the framework around the whole intervention
- Structuring work and consequently workload
- More support concerning coaching and education
- More formal recognition of the project team and its work (obtaining more credits for the project work)

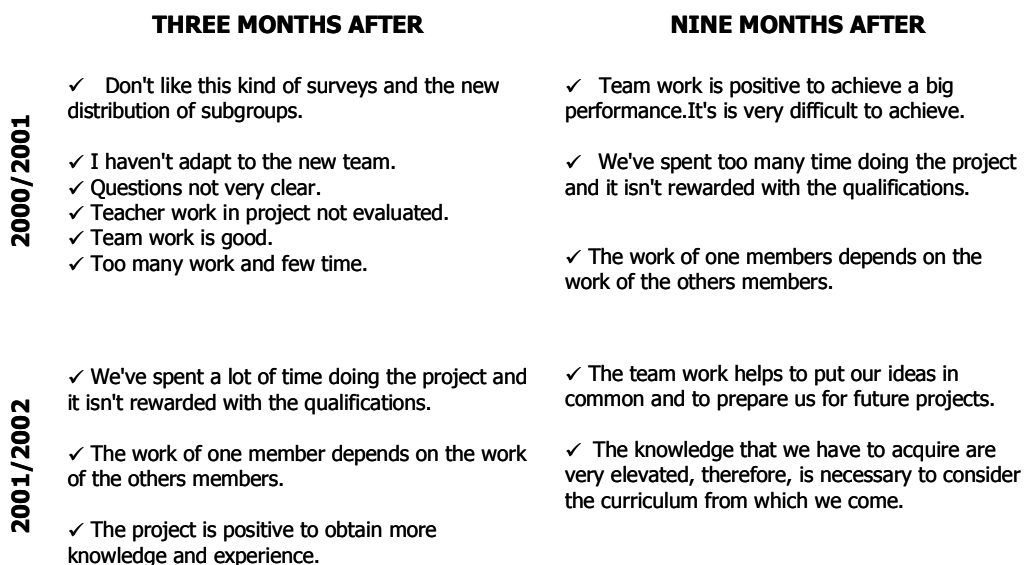


Figure 3.43. Comments and suggestions

Gender distribution in the surveyed population is conducive for teamwork, as there is no dominance of any gender as confirmed in Figure 3.44. A high percentage of female students support team work, as research indicates that women have higher social competencies [18], a skill contributing towards teamwork.

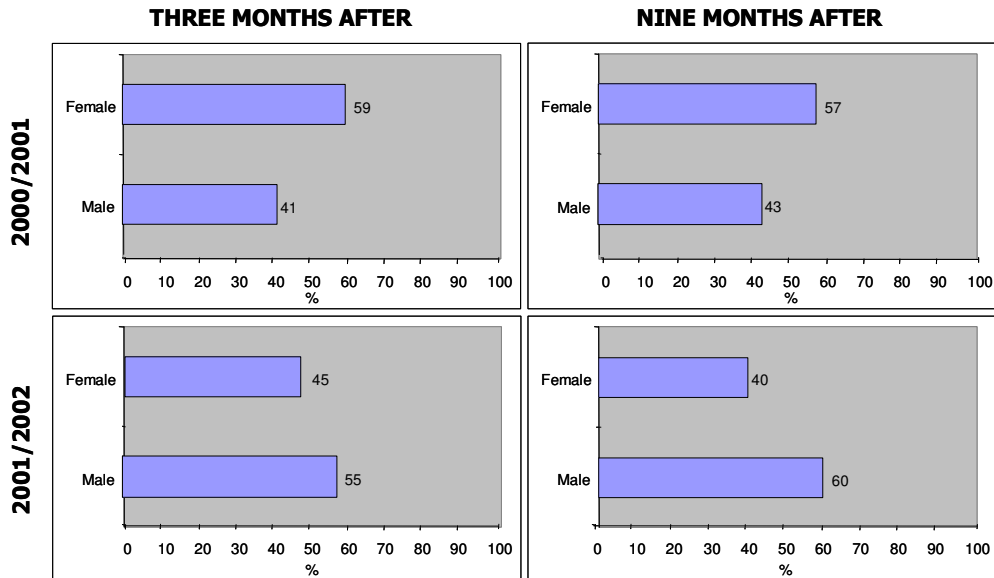


Figure 3.44. Gender of the surveyed population (NB: Gender composition change is due to changes in course registration)

As students are still at an early stage of their adulthood, there is a high probability of guiding them towards successful team orientation, as it has to be realized that abilities to learn become more limited with age [15]. The dominant age in Figure 3.45 is 17-20 year old students.

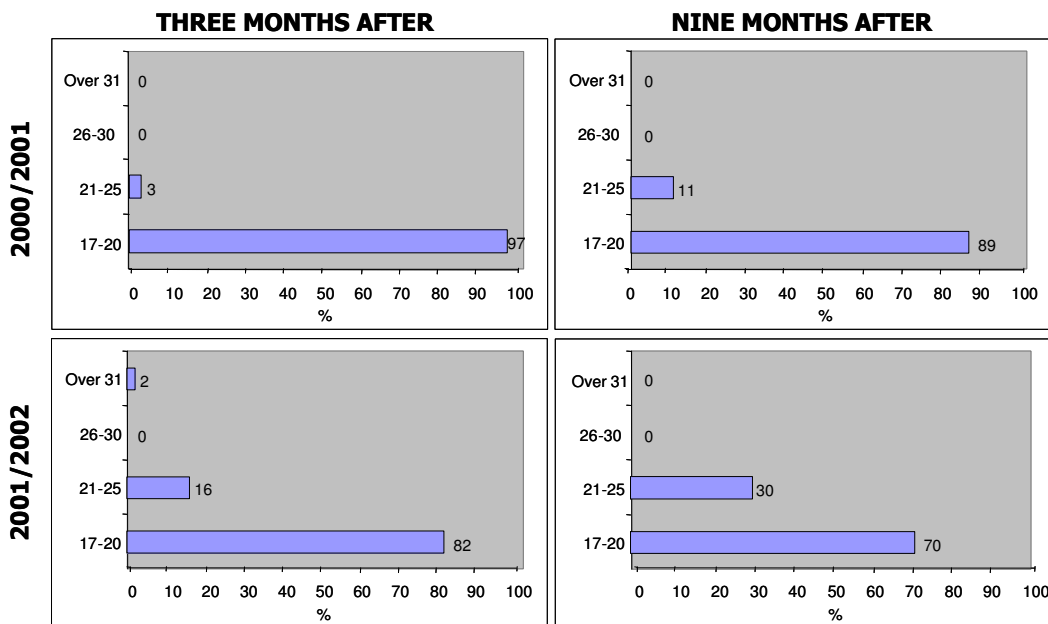


Figure 3.45. Age of the surveyed population

Figure 3.46 reveals that the overwhelming majority of students sought to study Chemical Engineering, i.e. it was their first choice of higher education. This calls for a high degree of commitment to begin with, which is an asset to build on, as it represents a high level of intrinsic motivation.

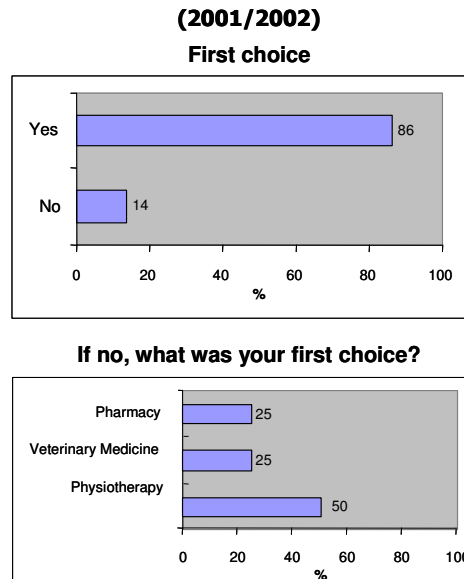


Figure 3.46. First choice of studies among the surveyed population in 2001/02

3.2.4 Survey 5 in 2000/01. Team Leader and Knowledge Manager 3 and 9 Months after the Intervention

In this subsection the survey results based on team leader and knowledge manager questionnaires are discussed. Due to the number of constraints mentioned at the beginning this chapter, it was only possible to run this set during the academic year of 2000/01. When looking at Figure 3.47, team leaders and knowledge managers (from now on team managers) reconfirm that common purpose and communication and conflict are fundamental ingredients of successful team functioning. Initially, there is no meaningful teamwork possible without common purpose. It is also known, that the ability to communicate and resolve conflicts constructively is directly proportional to team performance [8]. The topic of “New Member Integration” is of high priority for team managers. That does not come as a surprise, as the teams have to accommodate for a certain fluctuation in the course composition brought about by new students or those repeating the course.

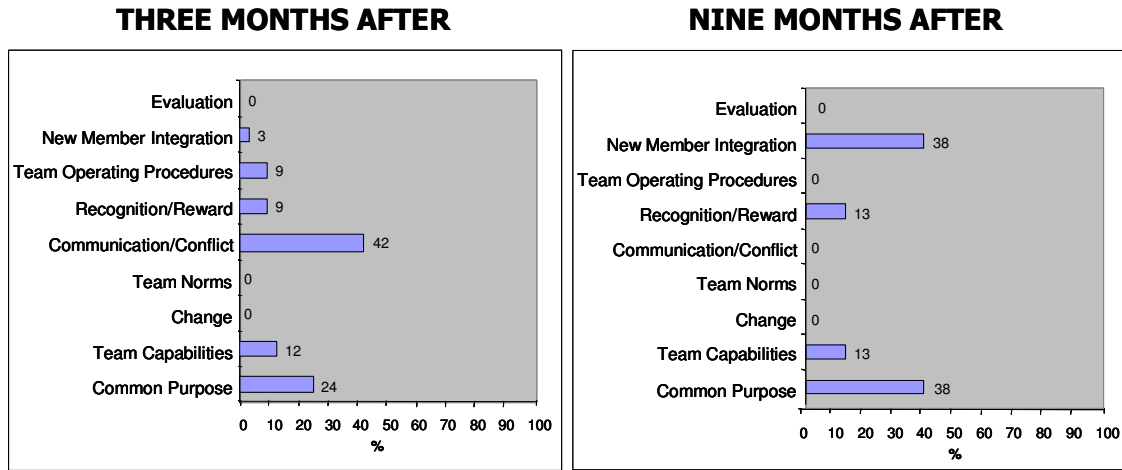


Figure 3.47. Most helpful module according to team managers

The importance of team education is validated by Figure 3.48, where team managers quote how the different training modules have helped them. It was stressed earlier that social skill building results in higher motivation and conflict resolution, which in turn increases productivity [7]. Over time integrating team members and finishing the project become the two highest priorities (38% each).

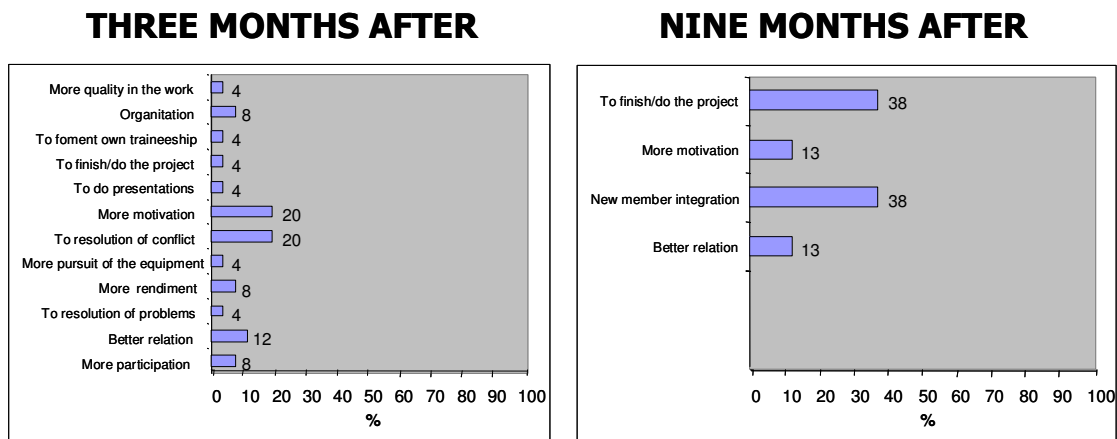


Figure 3.48. How high priority items have helped managers in the project

Figure 3.49 displays the evolution of project work in surfacing the team managers' greatest difficulties when working in teams. It appears logical that over time the issues of team operating procedures, team capabilities, and evaluation of team performance, become increasingly critical. When it comes to evaluation of team performance, understanding the critical issues and growing realization of their importance by team members is documented in their responses (see Figures 3.38 and 3.41). The topic of team capabilities is worthwhile exploring in further detail. It is not uncommon for team managers to underestimate team capabilities [19]. Future improvement plans point to the fact that team managers should be equipped with better skills and higher levels of knowledge to capitalize on team capabilities more effectively (see chapter 5). Again, education and skill building on both sides (managers and team) is critical. It is noteworthy that the word 'education' is of Latin origin and has an original meaning of 'leading out' [20].

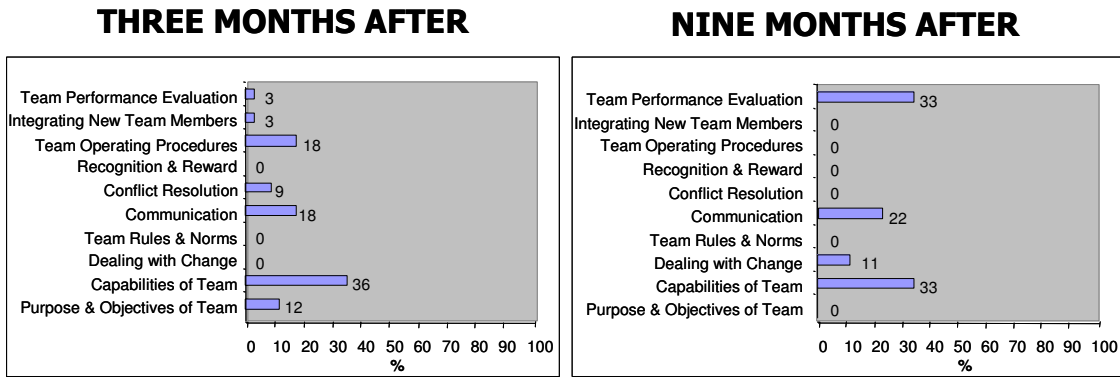


Figure 3.49. Greatest difficulties experienced by team managers during the IDP

When asked in which area the team managers needed additional help, again the communication and conflict issue comes up, as shown in Figure 3.50. There is an obvious need for on-going skill building in that area. Additionally, constructively dealing with feedback is perceived as important. When asked to suggest solutions for the areas identified in Figure 3.50, the team managers responded with the items as illustrated Figure 3.51. One could conclude from the results of these two figures that the ability to deal with feedback is directly linked to the ability to communicate and resolve conflict constructively. Team managers asked for additional training using the The TRACOM Group materials in “Enhancing Team Performance”©.

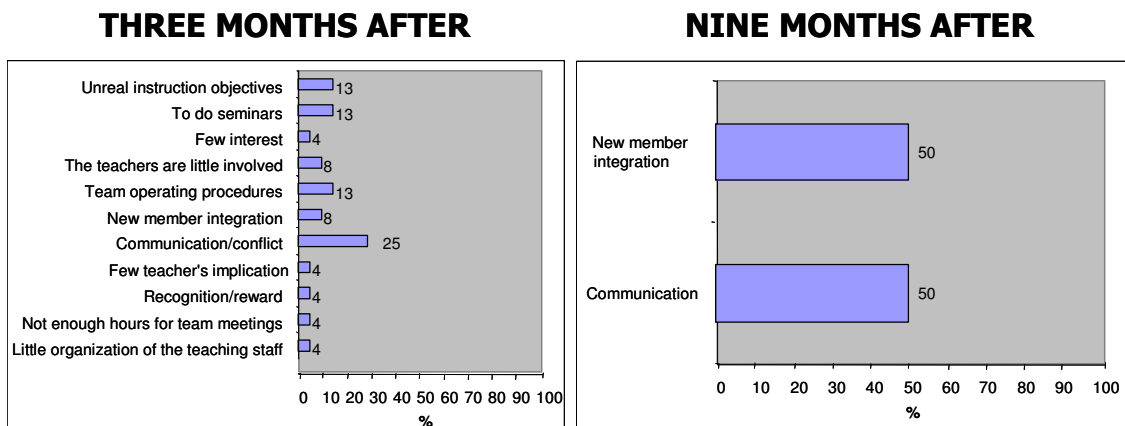


Figure 3.50. Areas that needed additional help according to team managers

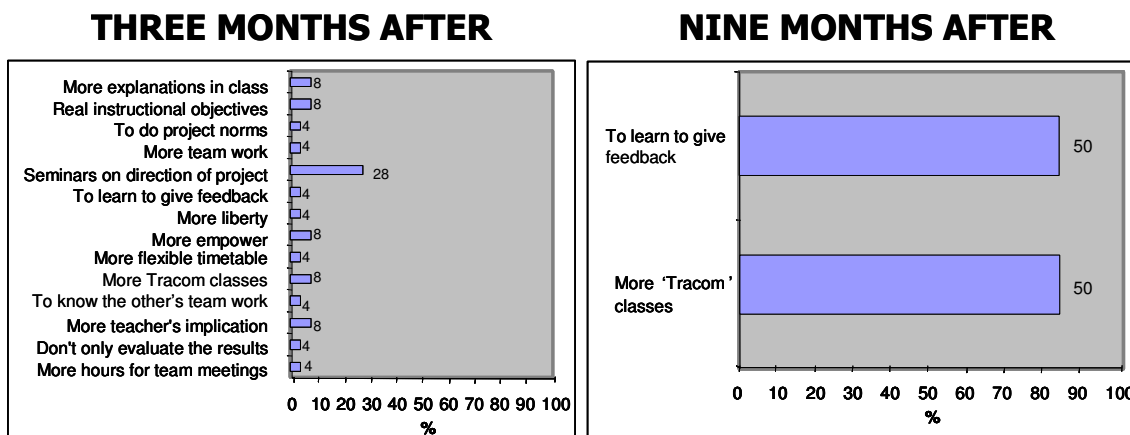


Figure 3.51. Potential improvement areas provided by team managers

Figure 3.52 deals with management style as perceived by team managers. It can be noticed that the “somewhat” category was particularly often used by the participants – an indication of some form of being indecisive. Apparently, the respondents avoid categorizing themselves, which is not uncommon in surveys. Employment of additional communication tools and further education would help to break the being indecisive pattern. One of the methods used in industry quite commonly is the “360° feedback”, which gives a better insight into how a leader is perceived by his/her environment [21].

Figures 3.52 and 3.53 show that team managers claim that they are “informal”, “inspirational” but also “methodical” in their style and role.

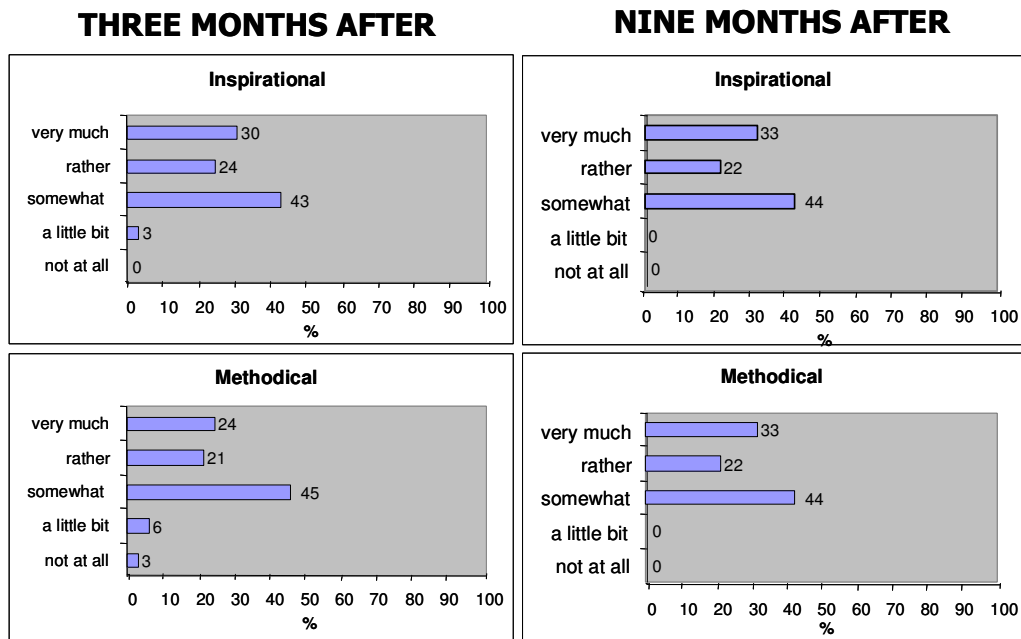


Figure 3.52. Management styles among team managers

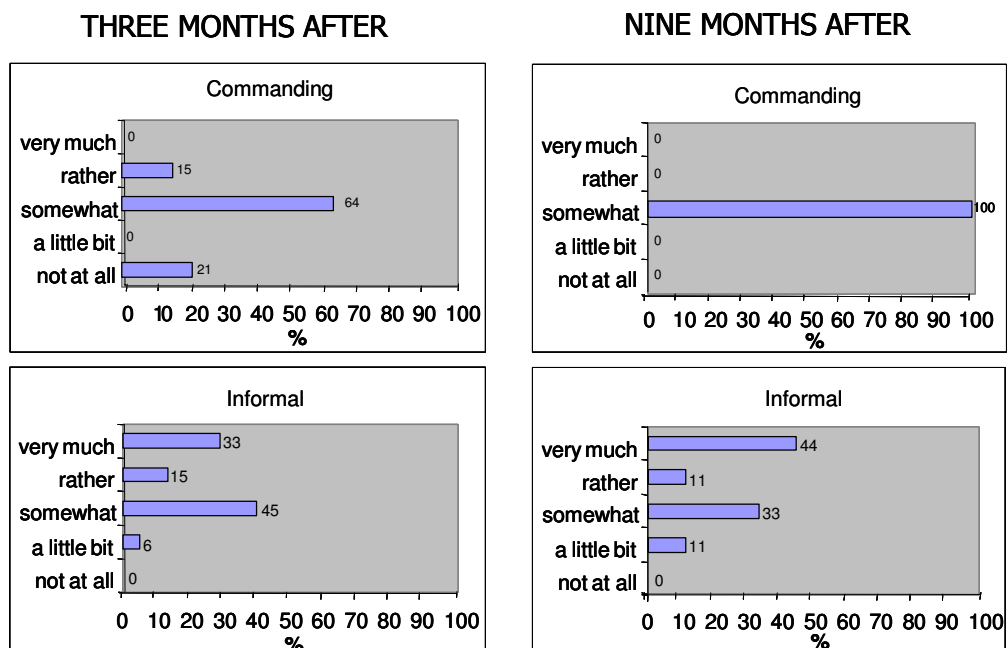


Figure 3.53. Team manager role description: commanding vs. informal

Team managers also portray themselves as people oriented, as depicted in Figure 3.54. It should be explored further whether the act of shifting from performance driven to people oriented has to do with the myth that good people leaders can not be performance focused. [22]

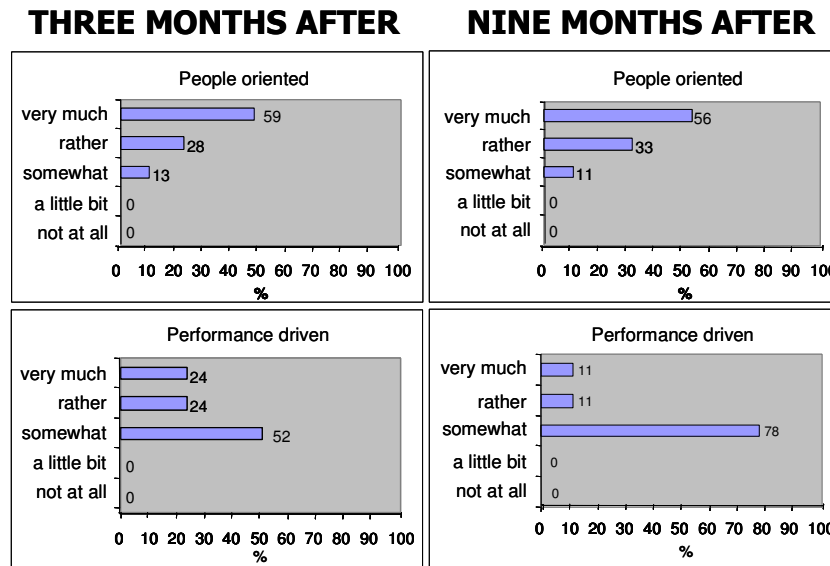


Figure 3.54. Team manager role description: people oriented vs. performance driven

All team managers a tendency to motivate with rewards, as shown in Figure 3.55. One of the critical leader tools is reward and recognition [23, 24]. This is the area where leaders generally struggle as a result of underestimating the importance of recognizing the team. Here it is also important to realize, that the potential of intrinsic motivation generated by meaningful work is generally underestimated. Some of the more modern thinking on recognition calls for team managers to be “removers of barriers” as employees are in general already motivated [23].

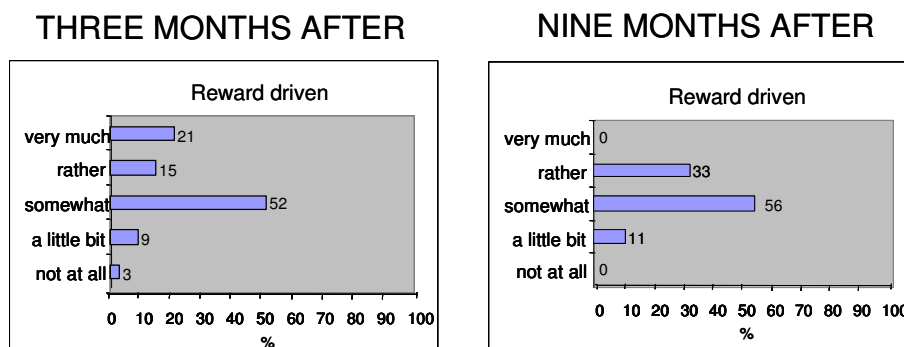


Figure 3.55. Motivation and rewards and recognition

When team managers were asked if they were mostly listening or mostly talking during team meetings, they perceive themselves as mostly talking, as depicted in Figure 3.56. This self perception is in conflict with responses regarding people orientation in Figure 3.54. One would expect good leaders to be good listeners. In areas for improvement (see chapter 5) proposals are made on how to obtain a more critical self reflection. This self reflection should translate into behavior

changed of team managers resulting in more empowerment of the team members [12].

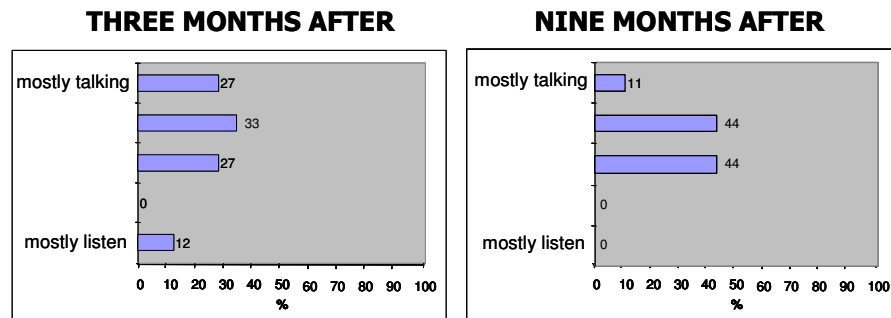


Figure 3.56. Team manager style: mostly listening vs. mostly talking

When it comes to evaluation of activities and their analysis, the trend is positive over the surveying period, as shown in Figure 3.57. This is congruent with the perception of the team members, as expressed in Figures 3.38 through 3.41. It can be concluded from the results in Figure 3.57 that team managers are shifting to monthly evaluation cycle, while team members are picking more responsibility for evaluation.

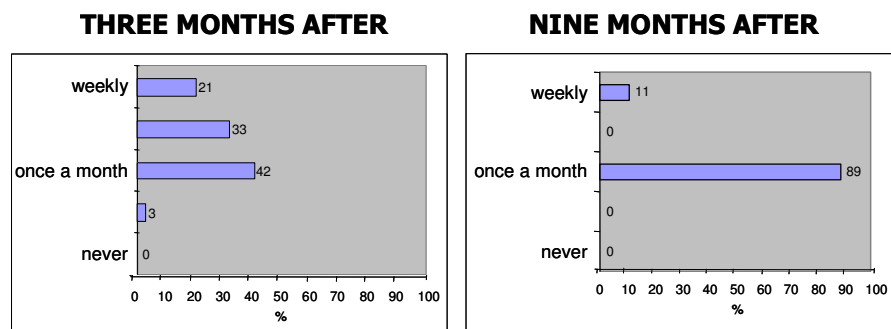


Figure 3.57. Frequency of evaluation of one's team's activities

A call for empowerment is present in the responses given in Figure 3.58 to the question: what are the most relevant activities carried out in team meetings by team managers and the time (%) dedicated to each of them. After 9 months into the project, planning and work assignment should be done primarily by team members and not by team managers as shown in Figure 3.58. Hence, this represents an opportunity for improvement (see chapter 5).

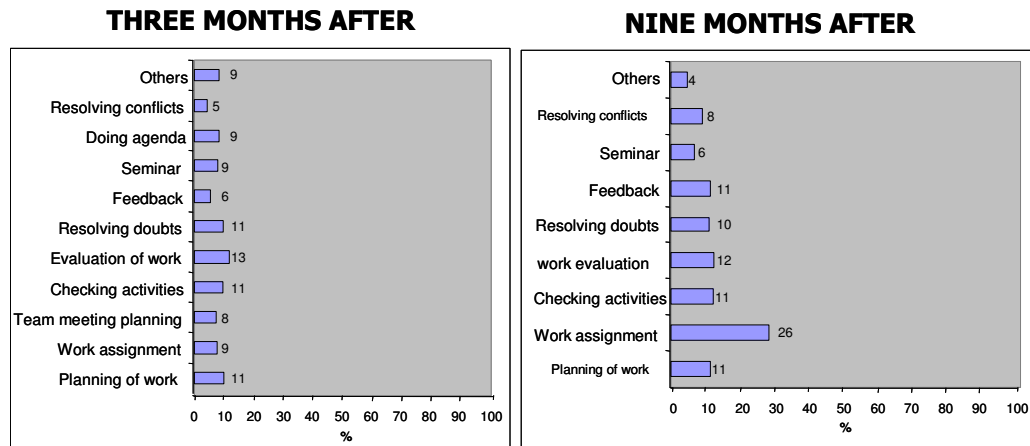


Figure 3.58. Most relevant activities carried out by team managers in meetings during the past 3 months and the time (%) dedicated to each of the activities

Like with the team member questionnaires, the demographic data was evaluated. It revealed that 1/3 of team managers were females, while the remaining 2/3 were males, with an age distribution of between 21-25 years.

3.3 Correlation between Education and Performance

This section reports on the first attempt to investigate the correlation between social education and academic performance. It has to be understood that this correlation stands as evidence in support of the hypothesis that social competencies enhance learning and consequently, productivity. The students' integrated project is evaluated on the grounds of both teamwork and individual performance. The team component is assessed through reports presented by each team, as well as by poster presentations, which are rated in front of an audience. Team rating is followed up by an individual evaluation, whereby each team member undertakes a skill based interview.

In the following, various ratings from different academic years are presented and discussed. The results attached are only qualitative in nature at this point in time and do not currently allow a final and definite confirmation of the hypothesis. Further research is needed in order to filter out noise factors, and to gather more data over larger periods of time. The model presented in Chapter 4 should allow for evaluation of both social and technical competences.

3.3.1 Comparison of Poster Presentation Marks

In the following graph the respective marks for the two academic years surveyed are presented. Because of the reasons explained earlier, there is only the graph for the first 4 months of the rating period for the academic year 2000/01. Twenty three teams were evaluated and the ratings per team as well as the average numbers are indicated. There is no statistically significant difference between observations.

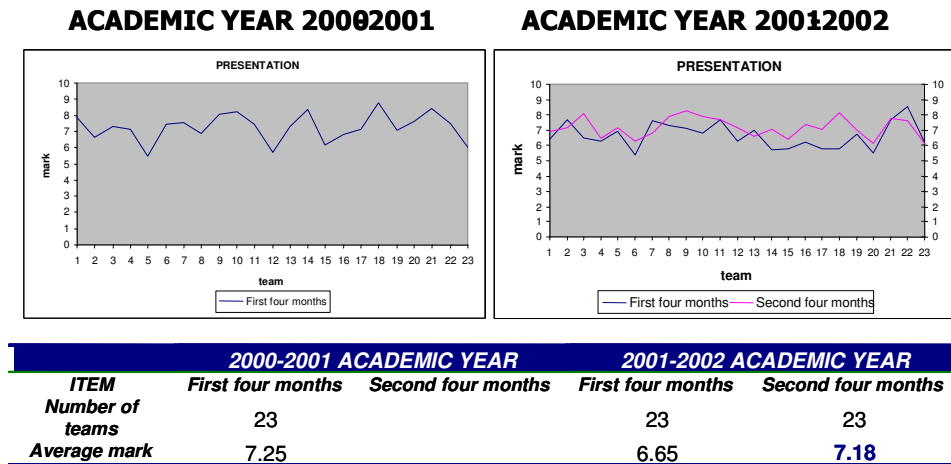


Figure 3.59. Poster presentation marks comparison

3.3.2 Comparison of Team Report Marks

When comparing the marks for the final project report in Figure 3.60, it seems that the performance is definitely better for the academic year 2001/02. This improvement is attributed to the social competencies introduced into the teams. This performance increase is also reflected in the survey responses, whereby they indicate higher meeting frequency, more open discussions, more evaluation of performance in the team and better interaction between all participants.

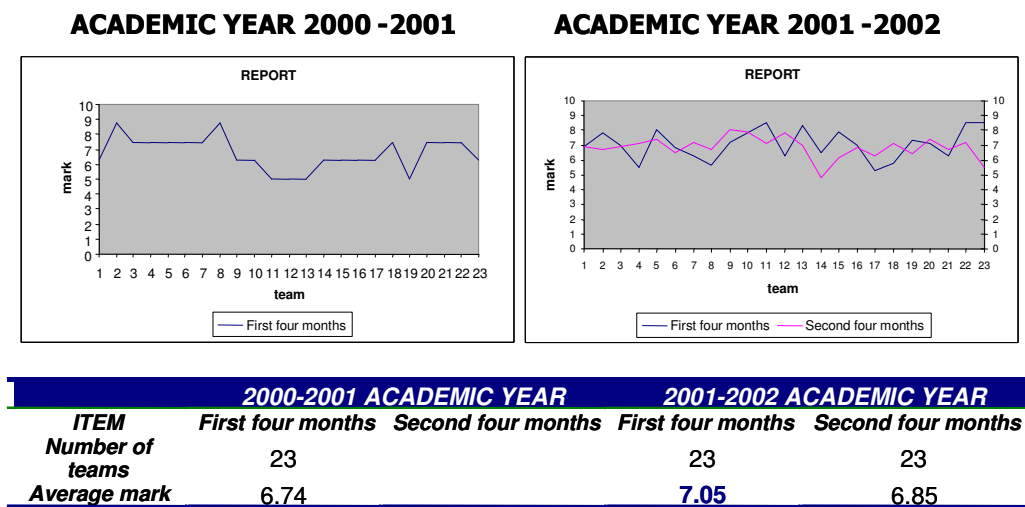


Figure 3.60. Team report marks comparison

3.3.3 Comparison of Individual Marks

The positive trend of Figure 3.60 for the presentation marks is amplified when looking at individual marks. As put forward in the hypothesis, changes in team patterns are projected to individual team members while impacting their behavior in a positive way. It appears that for the second round of the educated and surveyed target population, the results clearly outperform those of previous year. An additional contributing factor might also be the higher motivation level to begin with, since more students for the academic year 2001/02 had Chemical Engineering as their first choice of study.

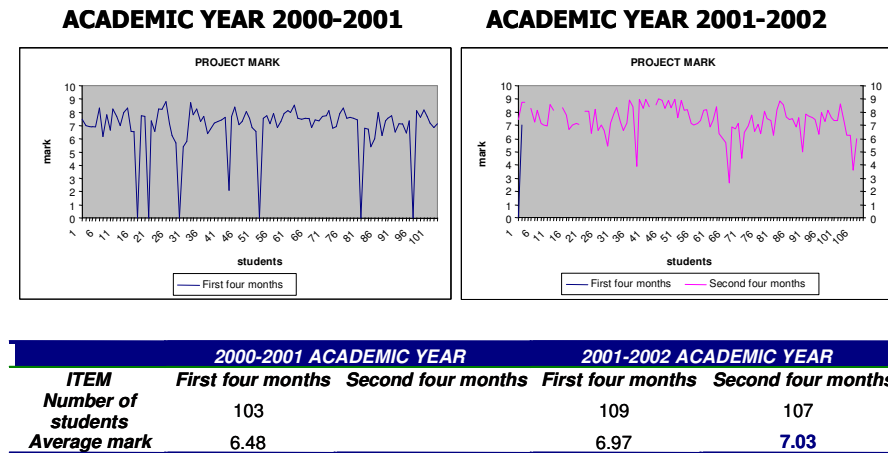


Figure 3.61. Comparison of individual marks

3.3.4 Expansion of Target Population

Initially, the target population of this research was the ETSEQ population exclusively, as this program was introduced by the faculty of Chemical Engineering (Enginyeria Quimica - EQ). However, during the 2nd year (academic year 2001/02) also students from the ETIQI (Enginyeria Tecnica Industrial – ETIQI) were exposed to the “Enhancing Team Performance©” course. This one time extension of the target population allowed some comparative analysis, which is presented below.

Comparison between the ETSEQ (EQ) and ETIQI student groups shows that over the first 4 months the students of ETIQI received only higher marks in the area of reports (see Figure 3.62).

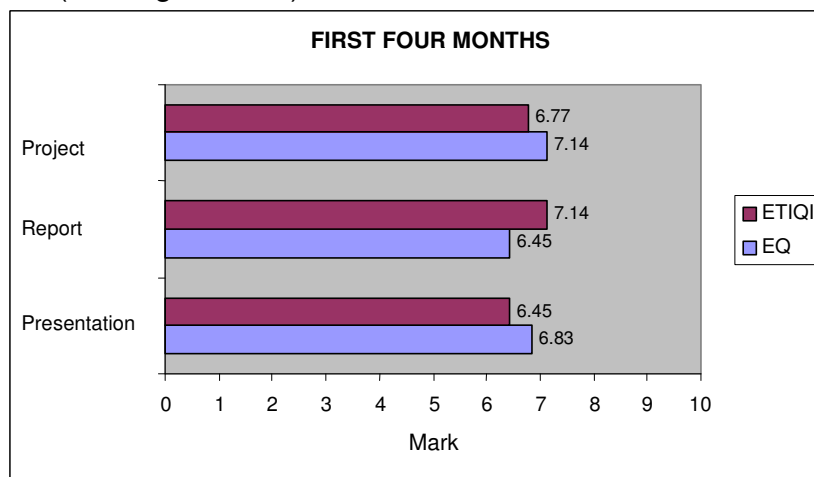


Figure 3.62. Comparison (first 4 months)

In the second 4 months the students of the ETSEQ (EQ) clearly outperformed students of the ETIQI faculty in all three categories, as shown in Figure 3.63. This would allow the preliminary conclusion, that the infrastructure around the social skill building is critical as it makes performance improvement sustainable. One time education seems to generate – if at all – only a short term improvement,

however not sustainable. Again, more research and statistical analysis is needed to solidify these observations and ultimately confirm the preliminary conclusions. It is suggested to expand this research by defining a control group, which would allow statistical proof of the hypothesis.

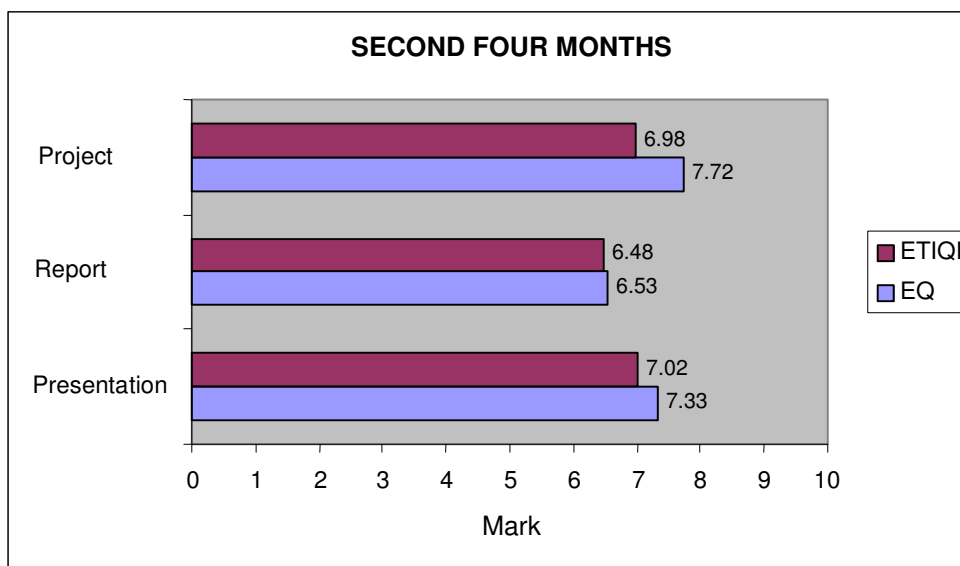


Figure 3.63. Faculty Marks Comparison (second four months)

3.4 Concluding Remarks

With the survey responses and the preliminary analysis of the correlation between social competencies and academic performance, there seems to be a qualitative evidence to confirm the hypothesis: Building of social competencies – in this case team building – enhances the learning and drives towards higher performance. This social competency is integrated into the technical curriculum of the ETSEQ as an external intervention and, thus, it is not reducing the time dedicated to technical subjects. It also becomes apparent that technical competence is, if not enhanced, fostered by social competence as proved by the higher marks of the integrated project. It can be concluded that the proposed design of the social competency building is working satisfactorily and delivering against expectations. With the proposed recommendations for improvements and additional data sets it should be possible to prove the hypothesis in a statistically sound fashion and at the same time improve performance and make these gains sustainable.

The surveys also indicate that the current set up, with the 1st and 4th year as the only integrated design project approach embedded into the chemical engineering curriculum is very vulnerable. If there is no further integration of the methodology into the curriculum, the result is a decrease in students' trust, as they realize that their efforts are relatively useless in the 2nd and 3rd years. This is aggravated by the fact that the final goal of reaching higher levels of empowerment for teams and individuals cannot be reached in one step. It takes considerable and consistent effort over the entire curriculum to move from leader directed organization in the 1st year towards a fully self directed/empowered team in the 5th year. The momentum generated by the success of the 1st and 4th year IDP

scheme (see Figure 1.4), jointly with the information gathered from the field testing of the external intervention “Enhancing Team Performance”©, has been used to conceive, develop, deploy and initially evaluate the new competency-based educational model that is presented in the following Chapter 4. The model summarizes and builds upon the landmarks of IDP at the ETSEQ depicted in Figure 1.5. The partnership established with Dow Chemical Ibérica, with the indirect support of the Dow Chemical Company, received in terms of manpower, training technologies and materials, was an important turning point in the journey of the ETSEQ towards and empowered institution. It is now the task of the top leadership of the school to take this model to the next level.

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