♦ Improving Quality and Productivity in Training: A New Model for the High-Tech Learning Environment

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In this paper we examine the recent success of study groups, an innovative approach to training used at AG Communication Systems, a joint venture of Lucent Technologies and GTE. This approach not only meets company needs, but is especially beneficial for adult learners. Study groups provide adult learners with a genuine educational experience. They focus on meaningful topics chosen by the participants; offer timely, convenient scheduling; and allow learners to direct their own learning. This approach also increases the retention rate of participants and helps them apply what they have learned to the workplace. A company can use study groups to meet current and future business needs and, even more importantly, to develop a core of identifiable expertise that will enable it to respond effectively to unanticipated change. In addition, the model is cost effective when compared with other training models. Along with these benefits, the use of study groups improves employee morale, which research has shown always results in productivity gains.

Introduction

In his book *The Fifth Discipline Fieldbook*, Peter Senge quotes Arie de Geus of Royal Dutch/Shell on the criticality of learning in today's high-tech organizations:

> In the long run, the only sustainable source of competitive advantage is your organization's ability to learn faster than the competition. No outside force can take the momentum of that advantage away from you.[1]

Senge goes on to say,

> The most important innovations in infrastructure for learning organizations will enable people to develop capabilities within the context of their jobs. We must learn to make our work space a learning space. Learning should be central, not peripheral.[1]

The recent success of study groups within AG Communication Systems, a joint venture of Lucent Technologies and GTE, has shown that this approach to training not only meets company needs and the needs of learners, but is also cost effective when compared with other training models. Study groups provide adult learners with a genuine educational experience, focusing on topics they have chosen. They offer timely, convenient scheduling and allow study group members to help direct their own learning. This level of involvement enables them to choose topics applicable to their jobs and also increases retention of the topics studied. In this paper we present data from study group experience and some lessons we learned from using this model.

In early 1997, one of the authors of this paper suggested to Charles Schulz, vice president of Product Development at AG Communications Systems, that it might be beneficial for the company to experiment with the learning technique of study groups, described in an article by Warren Keuffel.[2] The article contained enough information to make us feel confident about initiating the study group program. Now, however, we believe we have gone beyond the report to define our own view of study groups and their benefits. This

paper relates the results of our experiences, learned by administering our own study group program. We also examine the relevant literature to show that learning studies support the study group approach.

Keuffel explains the idea behind study groups as follows:

> Study groups are most commonly formed as small groups of individuals who select a book to read and discuss. They are often formed in organizations where individual employees wish to improve their technical skills and are willing to take the initiative in doing so… .[2]

The company buys the books for the groups and provides lunch at a weekly noon-time meeting. Participants are expected to prepare and meet on their own time.

Charles Schulz approved the idea for a pilot, and one of the authors sent out a call for proposals to engineers in Product Development. The engineers proposed 13 topics, both technical and nontechnical: analysis patterns, common object request broker architecture (CORBA), frame relay, Java,* Java Virtual Machine, negotiation, neuro-linguistic programming, optical communications, open systems interconnection (OSI) protocols for the telecommunications management network (TMN), Personal Software Process, software metrics, C++ Standard Template Library (STL), and Web-based instruction. The two topics chosen for the pilot were the Java Virtual Machine and Web-based instruction.

A proposal from a professor at a local university to conduct a course in Personal Software Process[3,4] led to the support of a third study group, this one given the additional task of evaluating the Personal Software Process approach and the texts available to determine whether the course proposed by the professor was appropriate for our company. Not only did the study group provide employees with a new learning experience, but it also gave the company an easy way of evaluating future course offerings. This was just the beginning. Study groups were going to prove useful, highly productive, and effective in improving our corporate environment.

In addition to the three fully supported study groups, employees formed two study groups on their own: Negotiation and Frame Relay. These two groups found management sponsors willing to pay for the books, but lunches were not provided by the company. These groups prepared and met on their own time, as did the fully supported groups.

Both the fully supported and semi-supported groups were expected to post information about their progress, including brief summaries from each week's presentations, on an internal Web site.

Panel 1. Abbreviations, Acronyms, and Terms

CORBA—common object request broker architecture
HTML—HyperText Markup Language
NTU—National Technological University
OSI—open systems interconnection
STL—Standard Template Library
TMN—telecommunications management network

Setting Up a Study Group

In his article, Keuffel[2] described the study group experience at Raytheon E-Systems in Falls Church, Virginia, initiated by Nathan Ward in the fall of 1994. Since that time, more than 400 employees have participated in 17 different study group subject areas. Initially, the approach generated a lot of enthusiasm, and that has continued. The topics covered at Raytheon included in-depth programming language studies, HyperText Markup Language (HTML), Java, Internet-related topics, object-oriented design, requirements analysis, and CORBA.

In general, the study group process begins with a call for proposals issued by the study group's coordinator. Raytheon and AG Communication Systems did this by broadcasting electronic mail to the entire organization. In response to the call, employees submit proposals. The proposal writer should have an exceptional interest in the topic and a willingness to lead a study group, but he or she need not be an expert in the topic. The proposal should include a description of the book, collection of papers, or other resources that will be the focus of the proposed study group, as well as any prerequisites for the participants. For example, knowledge of the Java programming language was a prerequisite for the Java Virtual Machine study group.

The study group sponsor then chooses two or three proposals from the list submitted. Another broadcast message follows, announcing the topics chosen, along with the information in the proposals. Employees interested in participating then sign up for study groups. The participants are selected on a first-come, first-served basis, with the understanding that no one may participate in more than one study group at a time. People who have not previously participated in a study group are given priority. The study group coordinator selects no more than seven participants for each study group (making a total of eight, including the coordinator) and maintains a list of stand-by participants until the first meeting to ensure a complete group of eight.

Study Group Meeting Format

Each study group meets weekly during lunch for ninety minutes. When participants arrive in the designated conference room, lunch has already been delivered and they begin eating and talking together informally. This half-hour of socialization at the start of the meeting is quite purposeful. Christopher Alexander et al. have documented the effect of communal eating on group cohesiveness as pattern 147:

> …communal eating plays a vital role in almost all human societies as a way of binding people together and increasing the extent to which they feel like "members" of a group. [Therefore, give every…] group a place where people can eat together. Make the common meal a regular event.[5]

As more participants arrive, the conversation naturally shifts from casual topics to the study group topics for that week.

Logistically, the socialization serves as a buffer, allowing participants the freedom of not having to arrive precisely on time. It also separates participants from their work environment, giving them an opportunity to put the morning's business behind them so they can focus on the upcoming discussions. Finally, the socialization helps to build the cohesiveness of the group. Participants grow to know one another on a personal level and come to have a respect for the diversity of experience, knowledge, and insight that each member brings to the group. The group develops an identity, and participants feel a sense of responsibility toward the group, which makes them better, more dedicated participants. As one group member in AG Communication Systems related, "Having lunch together helped the group become more comfortable socially, which I think led to better discussions as time went on."

After a half-hour of eating and socializing, the facilitator shifts the focus of the group to the week's presentations. Typically, the group schedules two presentations for each meeting, the nature of which are decided by the group. Usually, the presentation is a summary of a chapter and serves to initiate group discussion. The group allocates thirty minutes to the presentation and discussion of each topic. During a typical twelve-week session, each participant is expected to give three presentations. Preparing for a presentation to peers promotes deep learning of material. Knowing that a presentation is imminent lends an urgency to the learning that improves retention and enhances insight. We learn when we teach.

The book chosen by the Web-based Instruction study group was a compendium of 59 short chapters. Each chapter, varying from 5 to 7 pages in length, was written by a different author and covered various aspects of the topic. The facilitator, who had previous experience in the topic area, selected 24 chapters for the study group to review during a twelve-week period. Participants who had special interests in particular chapters requested slight modifications to the list. From the resulting list, each participant chose three chapters to summarize for the group. Every week the group discussed two chapters, beginning each discussion with a reading of the chapter summary. The Personal Software Process and the Negotiation study groups followed a similar process. However, their chapters tended to be somewhat longer, so they often divided chapters into smaller sections for discussion.

Although the Java Virtual Machine study group focused on a book, the group used it only for reference. Instead of reviewing chapters in the book, group members organized each meeting around a different facet of the machine specification, such as memory management, exception handling, or thread management. The group determined when each member

would present a topic, but the topics were chosen by each presenter as the group progressed through the meetings. Thus, there were no specific readings for each meeting.

The Frame Relay study group had just four participants, so they reviewed one section of a chapter per week. Had they tried to have two presentations per week, each participant would have been faced with preparing a summary every other week. This group continued to meet, even after the recommended twelve-week session had concluded and the other study groups had ended.

After each presentation is completed, the group discusses the topic. The power of study groups is most evident during this discussion. Each participant brings to the discussion a unique viewpoint, based on experience and preparation for the week's material. This unique viewpoint allows participants to learn more in the group setting than they could if they had simply read the material on their own. As Weinberg[6] reflected, "None of us is as smart as all of us!" At the time, he was referring to the software inspection process, but the application to study groups is clearly appropriate.

When one participant shares learning acquired through a unique viewpoint, the entire group benefits. New ways of looking at the material open other new insights. The process, an unfolding of learning, feeds on itself. One study group participant observed, "I'm always amazed at the many different insights that different people have from the same reading. I guess you have to program your life for multiple possible interpretations."

Obviously, each participant must prepare for each meeting and, more importantly, must attend each meeting. If participants do not share their insights, individual preparation is not useful to the group. Both the preparation and meetings take place on the participants' time, requiring a high level of dedication from all involved.

After each meeting, the study group leader or an interested participant posts a summary of the presentation and discussion on the Study Group Web site, available to anyone in the company who is interested in the topic. Employees outside the study group can read the material and follow the summaries as secondary participants. We also had one individual who participated in an "outer circle." She attended the sessions and bought her own copy of the book, but she was not allowed to make presentations or participate fully. Clearly, this role requires extraordinary interest and dedication, especially while other participants are eating company-provided lunches.

The Web summaries also provide an on-line resume for new projects looking for expertise in a particular area. The leader and participants of each study group are listed, and the summaries provide a clear record of the experience in each topic. AG Communication Systems' business leaders are interested in supporting study groups on topics that are relevant to new product areas.

Quality and Productivity: The Learner's Viewpoint

Learning in the workplace happens both formally and informally. Formal learning is commonly referred to as training. It is structured, supported by resources, and documented in terms of participation. Informal learning occurs in daily work situations, where workers solve problems of immediate concern. A resident expert conducts one-on-one tutoring or mentoring focused on solving a particular problem. As B. Cahoon[7] explains, such informal learning is often more important than formal training for learning computer-related skills.

Two common models for formal learning in the high-tech environment are instructor-led classroom training and independent study. Classroom training is typically designed in a didactic fashion, in which knowledge is transferred from expert to learner. Exercises may be presented as group activities, but, essentially, knowledge is imparted in the fashion of a download: instructors present information and learners are expected to absorb it. Knowledge is viewed as facts and learning as the acquisition of facts. Rarely is there a real sense of discovery. Instructor-led training is often delivered in a concentrated format, with learners obliged to attend class all day, for one or more days in a row. This can lead to information overload, because the learner simply cannot assimilate all the information presented in such a short time. As one AG Communication Systems employee described it,

"Going to a three-day class is like taking a drink from a fire hose." In addition, as course length increases to three or four days, learners become increasingly distracted by routine office tasks that are left untended. This is particularly evident in a high-tech workplace that relies heavily on electronic and voice mail.

The AG Communication Systems training experience with object-oriented design patterns[8] resulted in an interesting variation on the instructor-led model. In the three-day course offered as a pilot, participants reported that they were overwhelmed. Being asked to learn 23 patterns in three days was too much to expect, even for experts in object-oriented development. As a result, the course was redesigned, and the same material was offered over a period of five days.

On the first day, a full day of course work was presented. The second through fifth days were half-day courses with a half-day of optional consulting. This schedule gave some participants a chance to do other, perhaps critical, work, enabling participants who were interested and available to meet with the consultant and get help with their projects. This transfer of classroom knowledge to projects gave the participants a better understanding of the material than they could get from just a concentrated presentation of material. Although the cost for five days of training and consulting is greater than that for three days, typically these costs decrease per day over time rather than rise linearly. Switching to the new format dramatically increased the benefit to the company and the learners.

Similar experience is reported by T. Korson,[9] who advocates limiting the use of classroom training and interweaving training with mentoring. This type of approach addresses two problems: the difficulty of finding meaningful examples for use in the classroom, and the limited attention span of learners. The solution to both problems is morning training sessions and afternoon mentoring. This solves another strongly related training problem, that of long absence from voice and electronic mail.

Independent study usually relies on the techniques of videotapes, computer-based training, and broadcast distance learning from facilities such as the National Technological University (NTU). (Although it could be argued that NTU courses are built on a classroom model, the instructor-learner interaction is minimal. There is little, if any, learner-learner interaction, and social presence—the sense of sharing a common learning experience with others—is missing entirely.) Independent study provides more flexible scheduling for the learner, but it can be a very lonely process. With no cheering section and no one with whom to discuss the concepts and details of the material, the learner simply goes through the material in isolation and tries to absorb as much as possible. Both models—instructor-led classroom training and independent study—rely on *instructivist* approaches to education.

Study groups represent a very different model of formal learning from instructor-led classroom training or independent study. Because study groups are not instructor-led and there is no expert in the group, participants must build their own knowledge of the topic. They determine the path of exploration. The members of the group work together to build understanding by uncovering concepts and relationships. This *constructivist* approach is an important concept in modern group learning theory. Since the 1920s, the discussion method—described more recently by M. W. Galbraith and B. S. Zelenak[10]—has been as the quintessential method of adult learning. In the learning environment of the workplace, according to G. W. West,[11] collaboration in the definition of the learning process helps increase buy-in and ownership among the participants.

Study Groups Explore Topics in Depth

In a concentrated classroom course, students rarely have time to ponder what they have learned. In contrast, the extended nature of the study group experience gives participants time to read, reflect, write, and discuss. They uncover related issues and different perspectives and arrive at a depth of understanding that is very hard to achieve in the concentrated format of the typical training classroom environment. As one employee of AG Communication Systems reflected, "The topic being studied was too complex for an individual effort. A group effort helped the study tremendously."

Study Group Topics Are Timely

The employees of knowledge-based companies, such as AG Communication Systems and Lucent Technologies, must stay current in their fields, but rel-

evant knowledge changes quickly. The literature on workplace learning describes the half-life of knowledge as the time it takes for half of what has been learned to become obsolete. For technology-intensive fields, K. E. Watkins[12] estimated that the half-life of knowledge is less than four years. Indeed, for software engineers, the half-life of knowledge has been reported by V. J. Marsick and K. E. Watkins[13] to be as brief as two-and-a-half years. Such rapid change can make it difficult for employees to find adequate training. Many times, an interest in a topic goes unfulfilled because the learner is unable to find a suitable course. In some cases, the topic is so new that a course is not available. In other cases, the course offerings are too general to be useful. In the experience of AG Communication Systems, no courses in Web-based instruction or Java Virtual Machine were available. In fact, typical classroom training could not have provided an in-depth exploration of the Java Virtual Machine. Timeliness is clearly a hallmark of study group learning.

Study Groups Are Convenient for Learners

Busy engineers often find it difficult to take the time for classroom training. Study groups are convenient, because they meet during lunch for only ninety minutes once a week, making it easier for participants to schedule the sessions. And because the participants prepare on their own time, they can do it whenever they have an opportunity. In addition, they develop a dedication to the effort and a sense of responsibility for the group learning. They do not like to miss weekly meetings. Clearly, scheduling is a benefit of the study group learning experience.

Study Groups Foster an Intellectual Community

Study groups comprise like-minded individuals who not only enjoy learning for its own sake, but also enjoy sharing that experience with others. Learning together builds satisfying interpersonal relationships that can become the foundation for selecting future projects. Self-esteem improves as participants see that they can help their peers grow. They are intelligent individuals who like the challenge of new topics. When companies provide opportunities to these individuals, they build morale. When people feel better about themselves, they are happier and more productive.[14,15] Study groups, according to one AG Communication Systems employee, also have other benefits: "Group members discuss many issues actively, raise different ideas and thinking."

In the AG Communication Systems experience, participants, on average, spent an hour or more each week preparing for the week's discussions and an additional two hours when it was their turn to prepare a presentation. As participants had to prepare three presentations and summaries per course, within the twelve-week session each participant spent a total of about thirty hours—twelve hours in group discussion of the topics and another eighteen hours studying and preparing for those discussions. Not only were participants learning about the topic of the study group, they were also honing their skills in critical thinking, analysis, writing, presentation, and cooperative group dynamics. In addition, the study group leaders were improving their facilitation skills.

Quality and Productivity: The Company Viewpoint

Our results are consistent with those of Raytheon. Company management believes the benefits in productivity are well worth the minimal investment. Compared to other forms of training, the cost per learner in a study group is extraordinarily small (see **Figure 1)**. There are no instructor fees. Participants prepare and meet on their own time. The only costs to consider are the books (usually about $40 each) and the lunches (about $8 per person per week). Study groups usually meet for twelve weeks, making the cost per learner about $136.

Study groups are a bargain compared with their alternatives, listed below.

- Off-site training, 4 days, per person = $1600
- Local university short courses, 3 days, per person = $950
- External consultant, on-site training, 4 days, per person = $800

Off-site costs may also include travel, lodging, and meals. In contrast, typical costs for commercial, instructor-led classroom training are much higher, especially after the cost of the employee's time and expenses are added. Even if the benefit to the company were the same for study groups and instructor-

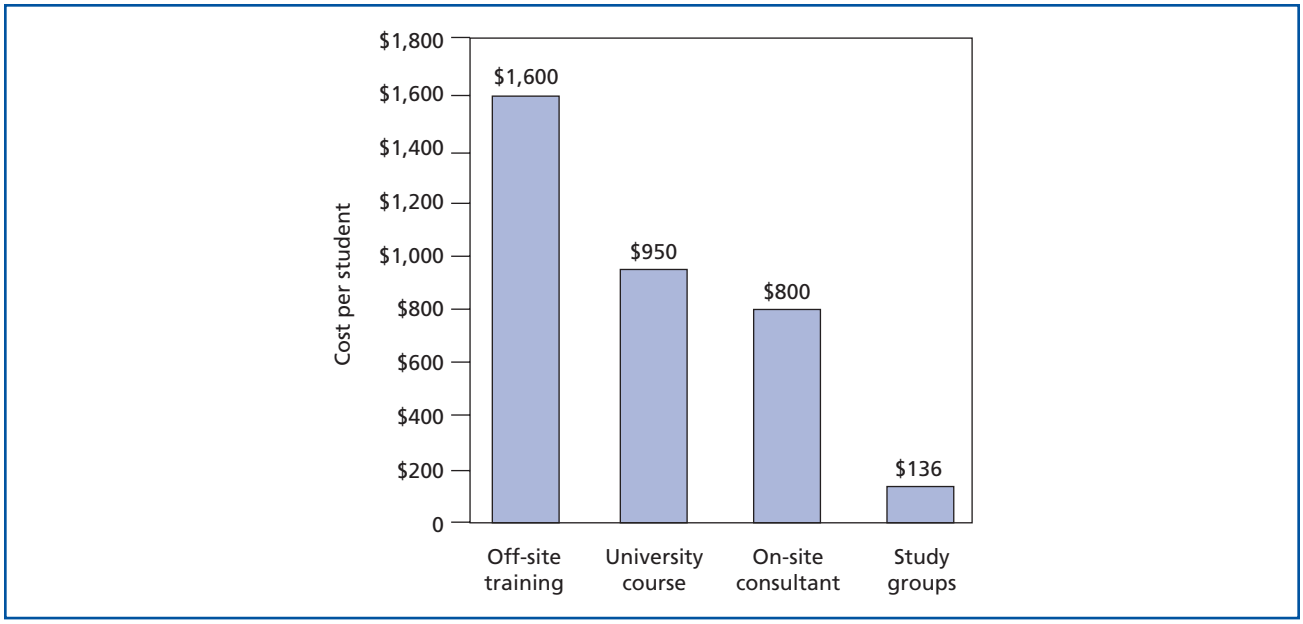

Figure 1.
Cost per participant for various types of learning.

led classroom training (and we think the previous section explains clearly why this is not the case), costs are significantly lower for the study group.

Obviously, traditional and familiar forms of training will continue to fill a vital role in the high-tech learning environment. For example, when it is necessary to learn as much as possible in a short time frame, a two-or three-day course requires less calendar time than a twelve-week study group. More importantly, not everyone is a candidate for the study group experience. Many people are uneasy in an interactive setting. Some find it difficult to give a presentation. Most, however, are comfortable with the traditional training model. We believe the positive experience AG Communication Systems has had with study groups can, in large measure, be traced to the enthusiasm of the participants. The people who were drawn to this pilot were the people who could make it a success.

Lessons Learned

We agree with the Raytheon observation that only a few study groups should be scheduled for each session. We also plan to schedule only two sessions per year, a spring session, which ends with the normal school year, and a fall session, which ends around the first of December.

Because motivation is critical for both the leader and the other participants, keeping morale high is essential. As part of this concern, a study group graduation ceremony caps each session. Refreshments are served, and certificates are awarded by our vice president, who says a few words of appreciation for the hard work of the participants. The special feeling that comes from simple, inexpensive rewards is an effective way to encourage employees. When companies are worried about hiring and keeping the best, this approach is very effective.

We also agree with Keuffel, who states:

> The single greatest determinant of success in any one study group is the leader's ability to maintain enthusiasm and interest in the book and discussion. This indicates that leaders who are good group facilitators stand the greatest chance of achieving success with their study groups.[2]

In adult group learning situations, a discussion leader must be able to guide the group without imposing a personal agenda.[16] This factor is so important that, for all future study group sessions, study group leaders will receive facilitation training to ensure they have the necessary skills to bring about a successful study group experience.

Limiting the number of participants in each group is critical both for ensuring the special feeling about participation and for enhancing the synergy of the group interaction. We have all felt this in large gatherings, where only the more powerful or more vocal attendees will speak. The effect of group size on adult learning is well known and clearly suggests that smaller groups are more effective.[17] As group size increases, the number of participants who never talk also increases. The number who have ideas that they do not express increases even faster. This effect is evident even in groups as small as five or six[18,19] and so predictable that Alexander et al. have described it in pattern 151, Small Meeting Rooms:

> The larger meetings are, the less people get out of them… . It has been shown that the number of people in a group influences both the number who never talk, and the number who feel they have ideas which they have not been able to express… . There is no particularly natural threshold for group size but it is clear that the number who never talk climbs very rapidly. In a group of 12, one person never talks. In a group of 24, there are six people who never talk.[5]

To this we must repeat our earlier observation about the people who learn best in the study group environment. These people are outgoing and work well where participation and presentations are required. They will self-select by making a proposal or signing up for a study group, while others who would be uncomfortable in this setting will choose more familiar models. This is certainly acceptable in today's environment, where diversity is encouraged. We should all seek the circumstances where we can perform at our best.

From the beginning of the session, the participants must have a clear understanding that a lot is expected of them. The supported groups will receive books and lunches, but all preparation and meeting are done on the participants' time. To ensure their full participation, they must show evidence of dedication to the topic.

Ordering an extra copy of each study group text for the company library and making it available to others who might find the topic interesting is a good idea. Management supporters must be kept aware of the benefits of the program by continually updating reports on the progress of the groups, including information about real-world application of the study group experience. For example, early in the life of our study groups we were happy to report that, as a result of her experience in the Web-based Instruction study group, one participant had created an on-line course for new hires in the System Test group.

Objective Results

Feelings about the success of a corporate experiment are good, but management supporters who provide resources for the experiment want to see data. Toward the end of the study group session, all study group participants completed an extensive survey. To ensure maximum participation, the survey was completed during a study group session. The survey was designed to gather data on participants' satisfaction with the format, level of participation, group dynamics, facilitator effectiveness, and the perceived value of the experience.

In the 1950s Donald Kirkpatrick[20] developed a commonly used model for measuring the effectiveness of workplace training programs. The model measures training effectiveness on four levels:

- Level 1—Participant satisfaction with the learning experience,
- Level 2—Actual learning,
- Level 3—Transfer of new knowledge to the workplace, and
- Level 4—Financial benefit to the company.[20,21]

An evaluation of the study group pilot made no attempt to measure learning (Level 2) or to determine the financial benefit (Level 4), other than cost (discussed above). The data collected, however, showed that the participants were extremely satisfied with the experience (Level 1). The format fit their needs and schedules quite well. The overall level of participation was remarkably high, and the groups functioned very well together. Nearly all the participants (92%) viewed the time they spent with their groups as highly valuable, and 57% said that the experience exceeded their expectations.

Every participant recommended continuation of study groups. Fully 95% said they would participate in another study group (those who would not cited the amount of effort required), and 75% would be willing to facilitate a study group. By the participants' own estimate, 73% expected to be able to apply most or all of what they had learned in the study groups to work situations (Level 3). Indeed, within two months of completing the study group sessions, two participants from the Web-Based Instruction study group had developed new instructional Web sites on the company intranet.

There were 36 participants in the five study groups—8 in each of the 3 fully supported groups, 8 in Negotiation, and 4 in Frame Relay. The study groups experienced no attendance losses, except for illness or vacation. In many cases, absent group members participated via teleconference. The study groups maintained a 91% attendance rate for the entire twelve-week duration of the session. Impressively, no one dropped out during the twelve-week session. Those who have participated in traditional training exercises know that if a project emergency arises, some people enrolled in a class do not even attend the first day of training.

Summary

Both Spikes and Senge, who quotes Arie de Geus of Royal Dutch/Shell, recognize the value of study groups to the employees and their respective companies:

> Employees must be encouraged to put in place a variety of learning-related initiatives that will allow them to become more knowledgeable, thus allowing their organizations to attain greater economic competitiveness. Employees must be given opportunities to learn and be rewarded for doing so.[22]
>
> Any insight or invention, whether it is a new way of marketing, a new product, or a new process, is really a learning process. At Shell, we saw we did not have to be too secretive—provided we were not standing still. If we continued to learn and generate new ideas, and incorporate them into our work, then by the time anyone had copied us we would be that much further along.[1]

The success of companies in today's high-tech environment depends on how fast their employees can learn. In this paper, we have shown the benefits both to the company and to the learner of a new model for training. As piloted at AG Communication Systems, the study group model has the advantages of timeliness and scheduling for learners and of cost-effectiveness for the company. The study group approach is clearly a win-win solution for high-tech training. As Senge has noted:

> Learning helps people embrace change. Change and learning…are inextricably linked.[1]

The company can use study groups to meet current and future business needs, but even more importantly, to develop a core of identifiable expertise that will prepare it for unanticipated change. Along with these benefits, the improvement in employee morale engendered by this type of learning will always result in productivity gains.[14,15]

*Trademark

Java is a trademark of Sun Microsystems.

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