



The Case of the Gaping Gap

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“How come our students asked so many questions in your sessions? They hardly open their mouth to ask any thing during our lectures!” This was the very first question the Director of the teaching institute shot at us when we first met him after our team from ATIRA finished our 6-days programme at their institute. What he perhaps implied but would not wish to express was the conclusion of the faculty based on their experience; ‘the students were either disinterested in studies or were dumb in the sense of being non-curious’. When the faculty had asked whether they could be present at our sessions with the students, we had welcomed them as observers. Their daily feedback to the Director must have been pretty strong on this matter of raising of questions by the students.

Several of us from ATIRA researchers cum consultants were expressing strongly the experience of the Indian textile industry that the textile courses taught at the teaching institutes leave a large gap between knowledge and its applicability under mill conditions. We had said that this wide, gaping “applicability gap” does really exist and methods can be devised to bridge the gap. An article was published, as early as in 1964, in Textile Digest, the earlier name of the Journal of the Textile Association, on the need to reorganize the year wise curriculum to make integration of knowledge given on different ‘subjects’ possible. In the decade of 1980s, the Director of this teaching institute had approached ATIRA and asked specifically, “Can you come and ‘bridge this application gap’ at our institute? How would you do this? The institute is willing to pay for your services, of course.” This was indeed an interesting challenge. We deliberated on this and decided to accept the challenge. We told them that three of ATIRA consultants/trainers will engage the 3rd and 4th (final) year students for 4 sessions of 1.5 hours a day for 6 days. Thereafter, the faculty and the Director can verify whether this gaping ‘application gap’ has been bridged, and if yes, to what extent. Our charges were the normal consultancy rates per day for 18 consultant days and travel and stay costs. That was accepted. As ‘per student charge’ for the nearly 70 students, this was quite nominal. (Of course, the institute paid the charges, not the participating students.) These would be the students who were taking spinning and weaving as their main course. So, our team consisted of a spinning consultant, a weaving consultant and one generalist trainer consultant for technology and management areas.

Three other Gaps!

Our discussions before we decided to undertake this assignment identified three gaping ‘gaps’ in our own capabilities. Firstly, none of us had any experience as lecturer to students of textile (or any other) courses. Secondly, with all the talk of the fresh graduates being not ready for job in the industry, no one from the industry had spelt out what exactly they wanted from the textile graduates. And thirdly, there was no precedence of any research or training institute attempting such a task of bridging the applicability gap; not only in India, but also in the world of textiles. We were literally gaping at these gaps, and realised that we had a truly ‘clean slate’ to write whatever we wanted!

Fortunately, each of us had gone through a textile technology course of 4 years, and from different institutes: Kolkata, Kanpur and Mumbai. Each one of us had taken training programmes for supervisors in mills and knew how to conduct these in such a way that the supervisors can use their newly learnt insights in their work for bringing about improvements. We could use this skill to bridge the first gap.

We knew how things were taught in textile colleges, and remembered our frustration on joining ATIRA about our inability to use the information we had been given. It had taken each one of us to turn this information into knowledge and then to use it fruitfully in mills. The use was for improving quality, for increasing machine and labour productivity, and for managing the processes of production systematically. Each of us had felt that we have learnt about four times as much in one year at ATIRA compared to the four years of the textile course. This meant that we could bridge also the second gap mentioned above. The clean slate was a double advantage: we could freely choose our methodology of teaching (the correct word, we came to know later, is pedagogy!), and in case we failed, we could always say “not failure but low aim is a crime”.

We decided that our sessions will be participative, with considerable prodding for ideas from the students, and with ample scope for them to raise questions and objections to whatever we were to say.

It is for this reason that we insisted on each session to be of 90 minutes, instead of the '45 minute class' the students were accustomed to.

The main reason why 'information' given in colleges does not become 'knowledge' that is useful for improvement in mill practices is that this information is given subject wise. Such separation subject wise is, of course, needed for teaching each subject fully. Consequently, the lecturer on spinning teaches only spinning, the one on fibre and yarn testing only that, and the lecturer on statistics does the same. Each lecturer teaches the subject almost without any connection with the other. When a student becomes a supervisor in a spinning mill, and he wants to improve yarn quality, he needs to use all three subjects simultaneously even to understand whether yarn quality is as good as the expected norms. He has to decide the sample size for testing strength, know which strength measure to use (single thread or lea strength) and why, and then decide whether the step for increasing yarn strength is to be taken at the drafting system at ring frames or in carding. In the system of teaching then (1980s), we knew that such a problem solving approach was not developed and taught in textile colleges anywhere in India. If our training programme of 6 days can make the students use their available information in this way to convert it into useful knowledge, the 'applicability gap' was most likely to be bridged. The 6-days course was then designed accordingly to expose the students to this problem solving approach and get them to use it right away as exercises.

Design and Conduct of the Course

Of the 6 days at the institute, the beginning would be in the afternoon; 1 sessions would be introductory and 1 review session with the faculty after the course. So, the planning was for 20 sessions. We decided that two batches students will be formed with each batch containing the 3rd year and 4th year students in the ratio 50:50 approximately. Each of the three trainers (for conveniently distinguishing between the institute faculty and ATIRA faculty) will address these two batches separately. This would mean that each trainer would take the same session twice. We allocated 4 sessions each for spinning and weaving, 2 sessions for process control in each, and 2 sessions conducting experiments in mills, and 2 sessions on using simple statistical methods for reducing time, effort and cost of making effective improvements. Two sessions were kept for improving the problem solving skills. This left 2 sessions free for use as contingency sessions.

The spinning sessions were for bringing out the relative technological contribution of processes and process parameters to the quality of yarn and to the productivity at ring frames. Similarly, the weaving sessions were also aimed at showing the effect of yarn quality and preparatory processes on thread breakage rate at looms. Parameters that need control for optimizing loom productivity were also dealt with. It is important to note that all this knowledge was created by research institutes, mainly in India, and also in other countries. All this knowledge was in the "public domain"; readily available as literature from research institutes and from textile journals, magazines and conference proceedings.

The sessions on process control were mainly to bring out the principles of what, why and when to control, including how exactly to control. This kind of thinking, based on the applied research and consultancy work done by ATIRA, was made available as Silver Jubilee Monographs published in 1974. The books Process Control in Spinning and Process Control in Weaving were widely read all over India. One of the reasons why this teaching institute asked ATIRA to do this programme for 'bridging the applicability gap' would as well have been these two 'handbooks'.(It so happened, that one author of each was on the ATIRA team doing this course.)

Our experience had shown that when mill technicians take actions for improving anything on the machines, they often fail to take the right precautions to check whether their action has really resulted in the intended improvement. This trial and error method resulted in too many errors in connecting the right cause with the observed effect. Therefore, the sessions on experimentation were to introduce students to the simple precautions needed to conduct a trial: in fact, to convert every trial into an experiment that gives reliable results. And to demonstrate by real life examples that this experiment is quite easily conducted in the mill without disturbing the normal working etc.

The sessions on statistical methods were needed because the variability of almost every instrumentally measured quality parameter or of the incidence of breakage rate is rather high. For illustration: An observer determines the end breakage rates on ring frames of makes A and B working on the same count for an hour each on one side of the machine (500 spindles) and finds that they are 10 for A and 20 for B, can we conclude that machine B is giving more breakages?

Not really, is the correct answer here! We had planned to keep the derivation of formulae etc. to the minimum, but to bring out the basic concepts. Simple formulae developed by ATIRA were to be made a part of the thinking of the students as they enter the mills as supervisors. (These formulae are also to be found in the book on process control.)

Seen in one way, all the above was to be done to impart the methodology and thinking needed for solving problems in the mills. Why then, the 2 special sessions on problem solving skills? These sessions were planned to demonstrate how one normally thinks of a large number of possible actions for improving any parameter, but that only a few of these are really relevant. The technological logic needed for eliminating the non-relevant items cannot be given in a lecture form, simply because the dry principles do not get seen or absorbed. The only way is to make the students go through such a process on their own, with some guidance from the trainer. We had therefore kept one session for an example in spinning area and another in the weaving area.

It is important to note that students taking spinning as their major subject were asked to attend the weaving sessions also, and similarly the weaving students needed to attend the spinning classes also. This was mandated for two reasons. Firstly, in mills, one often finds different opinions on causes of a problem between the spinning and the weaving department. (For a spinning mill, between the mill and the weaving unit client.) A common understanding on resolving technical issues would help both sides to arrive at mutually agreed conclusions. Secondly, the methodology of defining and solving problems being the same, for spinning or weaving (or for any other process of manufacture) it would get reinforced via such dual attendance.

The course was conducted as designed above, but starting with the first of the two sessions on 'problem solving skill'. We were fully aware that no one had ever talked to students about a mill problem and on how to look at it for solving it. Even so, we wanted to start our interaction with students using this topic. We had three reasons for planning this as the very first encounter with the student groups. Firstly, to demonstrate that the information that they have gathered during their textile degree course was quite good. Secondly, to open them up for talking freely about their ideas in the presence of others, without any hesitation about being 'right'. Thirdly, to let them learn how to go about sifting the 'wheat from the chaff'; how to go about eliminating as many of the possible action alternatives so as to come to the least possible number of relevant actions.

Again, it must be remembered that such formal thinking about why we have designed, planned and conducted the course was not to be shared with the students at all. We knew that talking about such things would not make any sense to the students, and even to the faculty at the institute. The students needed to go through this learning experience during the entire 6 days programme. Thereafter, if these ideas were to be talked about, they would immediately be able to see for themselves that these learnings have taken place. We had planned to tell the faculty of the institute about these ideas AFTER the course was over, in the final session with them.

This very first session was taken by the generalist from the ATIRA team. His opening remarks were designed to encourage each student to participate freely, to express his idea without wondering about whether it is 'right' or about what the others will think of it. After all, this 6 days course is meant to help them become better supervisors when they go to mills for jobs. "No examination or assessment of ANY KIND will be done by either the visiting team or by the institute for any student who participates in the programme." So much so, that from the side of the ATIRA team, there would be no compulsion to attend this programme! "YOU attend and participate because YOU want to equip yourself better for obtaining a good job and for doing well as a supervisor right from the day YOU join the mill that selects YOU." Not even a certificate of participation was offered to the students; neither by the institute nor by ATIRA. The sessions for all other topics were similarly taken with a view to make the students think on their own, participate, question the ideas being conveyed by the trainer by stopping him any time, and not to accept something that they do not quite see as right or are unclear about.

As an illustration of how the students participated vigorously, vociferously and enthusiastically in this entire course, let us look at how the very first encounter went off. A typical mill situation was presented; "When you join the mill that has selected you, you are told that the end breakage rate at ring frames is high. Do whatever is needed to reduce it." A simple question was asked: "What could be the reasons for high end breakage rates at ring frames?" Like a brain storming session, all the answers by the students were listed on the black board.

It so turned out that they numbered around 52! The trainer then started taking each of these for discussion, again seeking views from students. Several got eliminated by students, other than the original proposer, giving logical technological reasons. Some other were found to be untenable taking the effects of processes into account. (For example, poor opening of tufts of cotton in the blow room would not be a cause since carding separates the fibres thoroughly.) In some cases, the information available to the students was inadequate, mainly because text books do not mention such things nor does the faculty in their teaching. Such was supplied by the trainer. He also gave them reference like the book on process control where they could find such knowledge based on applied research done the world over, mainly in India under Indian conditions. Probability of a cause occurring was also taken into account. (e. g. fibre breakage in blow room as a cause was eliminated because it is extremely unlikely to occur). These ways of looking at causes and sifting them became an interesting 'play' in which students vied to eliminate as many causes as possible on their own. By the time the session was nearing the end, the class had zeroed in on just 3-4 most likely causes. Then a question was raised. "On which of these causes will you take actions first and why?" The discussions then led the students to understand the implications of time, effort and cost needed for the action and its likely result in terms of How Much reduction in end breaks. They learnt that priority for action needs to be given taking all these points into account.

It was an added advantage that some or the other from the institute faculty was present in most of the sessions conducted by the three trainers from ATIRA. They had been specifically requested to play very strictly the role of an observer; and were asked NOT to participate in any way during the interactions with students. Nor did any trainer talk about the sessions with any in the faculty after or before the session about the contents and the methodology of taking the session. The faculty observers were expected to draw their own conclusions on WHAT is happening during the sessions and WHY. Their observations and conclusions would help in the final session planned exclusively for the trainers to interact with the faculty.

In conclusion

Let us look at the process of conducting this experiment in 'bridging the applicability gap' at this teaching institute from the point of view of each stake holder: the trainers from ATIRA, the students who were the intended beneficiaries, and the faculty of the institute led by the Director.

Trainers: As mentioned in the beginning, the training team had identified three gaps in their own capability and had found ways of overcoming them. The enthusiastic participation by a large majority of students in each of the sessions left them in no doubt that their methodology is functioning well. The unsolicited, informal feedback from a large number of students, given often outside the working hours, (the ATIRA team was given accommodation on the institute campus) conveyed that they are benefitting from the new ways they are learning to use their knowledge. It appeared that the goal of bridging the gap had succeeded.

Students: The ATIRA trainers had avoided seeking any formal assessment of the effectiveness of the course from the students in the form of a standard questionnaire. Such questionnaires usually seek opinions of the participants on aspects such as contents, delivery and their feelings of satisfaction. [We have not come across even a single programme where the average assessment of all participants is less than 'Good'! This was the conclusion from the review done by ATIRA in 1969 of all its training programmes conducted before 1969. When asked, "Where did you use the knowledge gained in this programme?" the answer most often was 'do not remember', and rarely 'mill situation/my boss did not allow'. In other words, the programme content was not used. In this case, the 'use' of the new learning was to be in future.] We had decided to learn about the usefulness of the programme from spontaneous comments of the students, during and after the sessions and also after the programme was over. These informal feedbacks were quite positive. Several students conveyed that they will be able to fare much better at the selection interviews taken by mills. Several others said that this way of tackling mill problems will help them in their career. Several asked whether all this thinking can really be allowed to be used in the mill until they reach a senior level a few years later. The trainer team received any such comment with a smile, but without expressing our judgement on these remarks. We had learnt, from earlier experiences, that the effect of any training programme is usually positive immediately after it is over. But the long term gains from such learning and its effective use in mills are a different matter.

Faculty: The Director of the institute had arranged for a meeting of the three trainers with all the members of the teaching faculty of the institute, after our programme was over. We had suggested to him that we would like to interact with the faculty to get their considered views on the process used for 'bridging the applicability gap'.

Those from the faculty who had attended one or more sessions gave their feedback. In brief, they were surprised to find most students asking very many questions, giving answers also several times and making comments quite often. They had not found this happening during their lectures. But they did not quite understand the reasons behind this very different behaviour of their students. What did the trainers do that was different from what the faculty normally does? Their second major feedback was on contents: each had noticed how each of the ATIRA trainer was using knowledge from different subjects while dealing with a topic in (say) spinning. So, they had made a mental note to incorporate such cross-subject ideas in their teaching that spinning topic etc.

Consider their question “How come so many questions from the students?”. We tried to probe into the experience of those faculty members who had attended as observers. Certainly, they had seen and heard what was happening. However, it was not easy for them to pinpoint the factors in the process of the trainer-student interaction that led the students to ask so many questions. We then stated these ‘factors’ as follows: telling the students that they will get more out of this course if they pay attention to what the speaker is saying and think about it (taking notes was not allowed, no examination of what they learnt was intended) ; then stated openly that questions are welcome at any time during the talk or discussion, and we practically demonstrated that we mean it; we also clarified that they need not hesitate to express themselves because their idea might not be ‘right’ or wondering whether others will consider it ‘poor quality’ etc.; we also encouraged them to discuss each other’s ideas, not just those given by the speaker, and encouraged this kind of Q&A among them within limits of time. After these points were made, the observer faculty realised that such indeed was the case and they agreed that this way of dealing with a subject had encouraged the students to be free with questions and comments. We then added one more point: whenever the trainer was not sure that he had a meaningful answer, he would simply admit that he does not know! And then add, “It is OK not to have answers to all questions, otherwise why would we need research?” Sometimes the trainer would say” Let us find out together.” And sometimes,” Let me see whether a good answer exists in literature.” But in no case would the trainer pretend to know the answer and give an explanation that even the students would possibly see as unsatisfactory. This due humility on the part of the trainers also helped in raising all kinds of questions.

At this stage, we decided to talk about our diagnosis for the existence of the application gap and how it could be bridged by the teaching faculty during the four years of teaching the different subjects included in the syllabus. After this week long experiment on interacting with the students for bridging the gap according to our way of thinking, of which we were uncertain before the course was conducted, we were reasonably sure that the methodology developed by us would work in practice. So, we conveyed to the Director and the faculty that the main reason for the gap was the nearly complete separation of one subject from the other during teaching. They had already seen how the ATIRA team had developed topics for sessions in a different way than that normally used. This was possible because the students were already familiar with the processes of spinning and weaving. But calling in a team from outside every year is not going to help in the long term. Firstly, outside trainer teams would not like to commit for any yearly contract for several years. Secondly, this one week exposure was good, but we still do not know whether it is good enough to give satisfactory results when the students take up mill jobs. Therefore, the right solution would be to incorporate the principle of integration of subjects into the teaching system at the institute.

Accepting that subject wise separate teaching is unavoidable, we need to find out how best integration of relevant subjects can be done to help students see the way in which problems occur or need for improvement is felt in the mills. This would require each member of the faculty to be familiar with peripheral subjects and also with the situations where several subjects need to be used simultaneously under mill conditions. It would also entail incorporating ‘group discussions’ on problem solving from time to time during the teaching programme. While the faculty members and the Director understood these needs in principle, they expressed that it would be difficult for any faculty member to be as widely knowledgeable as the members of the team from ATIRA. After all, they said, each of the trainers had a strong background of applied research, of giving consultation in mills and conducting training programmes for supervisors. While agreeing with this observation, we pointed out that ALL the knowledge we used for mounting this programme was in the ‘public domain’. More than enough publications are available for the faculty of any institute to put together the knowledge that we had used to interact with the students. This statement of ours was confirmed by the observer faculty members in an indirect way. When asked, what new technical knowledge they learnt from our team’s lectures/discourses, the response was, “Hardly anything really new.”

The ATIRA team returned to Ahmedabad and back into their normal work. And the faculty went back to their normal work of teaching students. Whether the faculty as a group or some individuals incorporated some of the concepts we had tried out, we did not get any feedback. Nor did we get any feedback from the Director on whether the institute would try out the 'discussion method' used by us. On our part, we did not seek any feedback; after all, our team was called to do a one-week programme for the institute; not for advising them on pedagogy.

Post Script: In the 5-10 years that followed this course on 'bridging this gaping gap', chance encounters with mill personnel brought some pleasant surprises to each of our team members. Someone, whom we had quite forgotten that he was one of those 70 students who attended our course, would seek us out and convey how he still remembers his experience of undergoing that course. Some would also add that it helped him in interviews for getting better jobs, in the work at mills and in getting faster promotions through smart work which gave good results in mills.

Imagine how much better the teaching programmes at colleges giving education in textiles would become if they were to develop and use methods to help their students integrate the subjects they learn separately. They will ask questions after questions and make many comments in the process of learning, and imbibe the learning deeper. Such integration in the context of solving mill problems or of improving the working will help them to adapt to mill situations much faster. This change would go a long way to reduce the proverbial 'application gap' between knowledge and its use in practice. In over thirty years that have gone by, several features of this kind may have been implemented in the teaching programmes of textile colleges of the 21st century. Hopefully, 'the gaping gap' between knowledge and applicability is not so widely gaping any more.