TALE - 2 Course Design and Instruction of Engineering Courses
Prof. K Rajanikanth
Former Principal - MSRIT
Indian Institute of Science, Bengaluru

Lecture - 16
Evaluating Laboratories and Electives

Greetings, welcome to module 2 unit 16 - Evaluating Laboratories and Electives. In the last unit we saw the design and use of Course Exit Survey.

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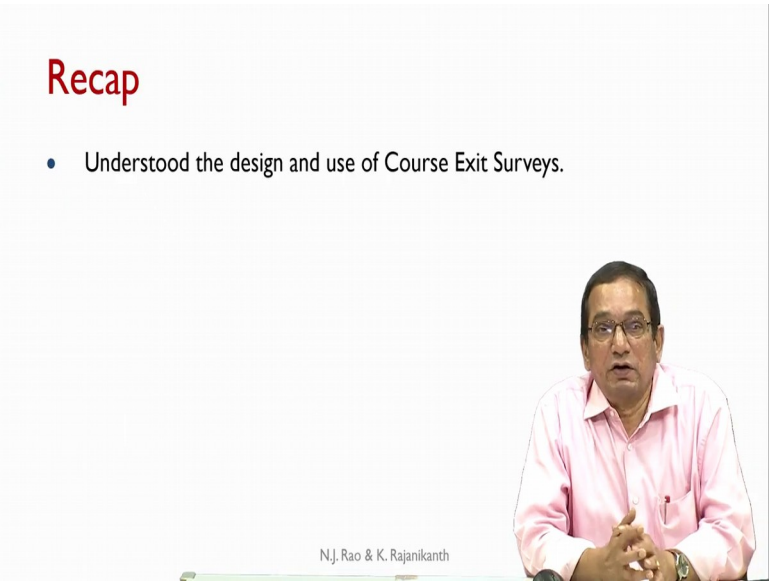

And that particular form that we saw in the "Design and use of Course Exit Surveys" is quite general. It is applicable to any kind of a course, but when it is concerned with the laboratories and electives, certain specific issues crop up.

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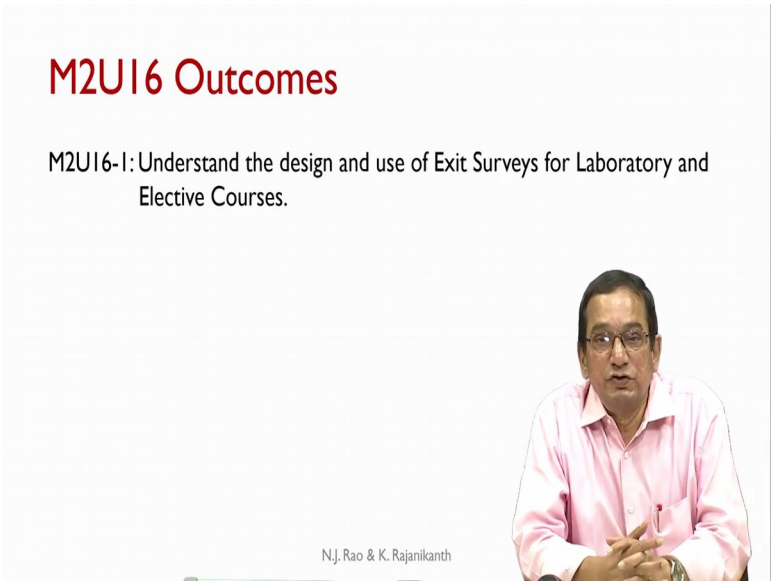

In this unit we look at the design and use of Exit Surveys for Laboratory and Elective Courses. The outcome for this unit is: Understand the design and use of Exit Surveys for Laboratory and Elective Courses.

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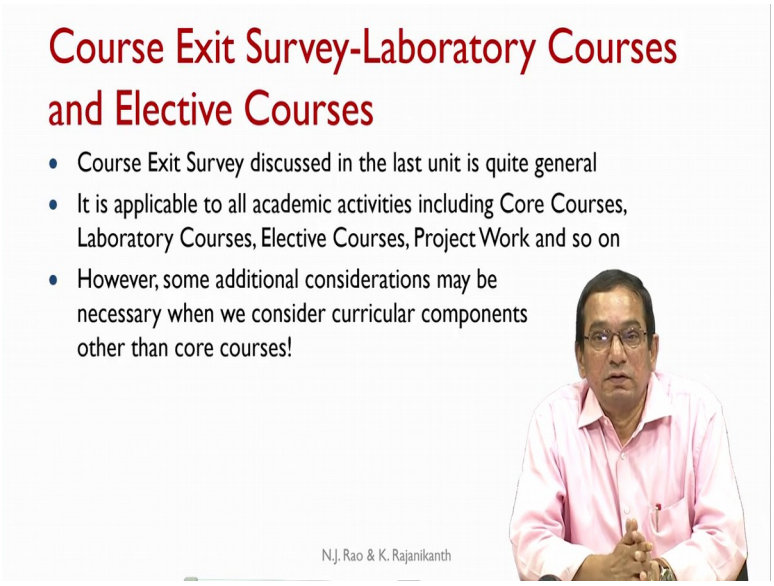

Course Exit Survey discussed in the last unit is quite general. It is applicable to all academic activities including Core courses, Laboratory courses, Elective courses, Project work, Internship and so on.

However, some additional considerations may be necessary when we consider curricular components other than the core courses. So, the survey, the from that we looked at in the last unit is more applicable for core courses. And while it is general enough to be applicable to other components, certain additional issues may have to be taken into consideration in designing and using Course Exit Surveys.

So, in this unit we look at laboratory courses and elective courses.

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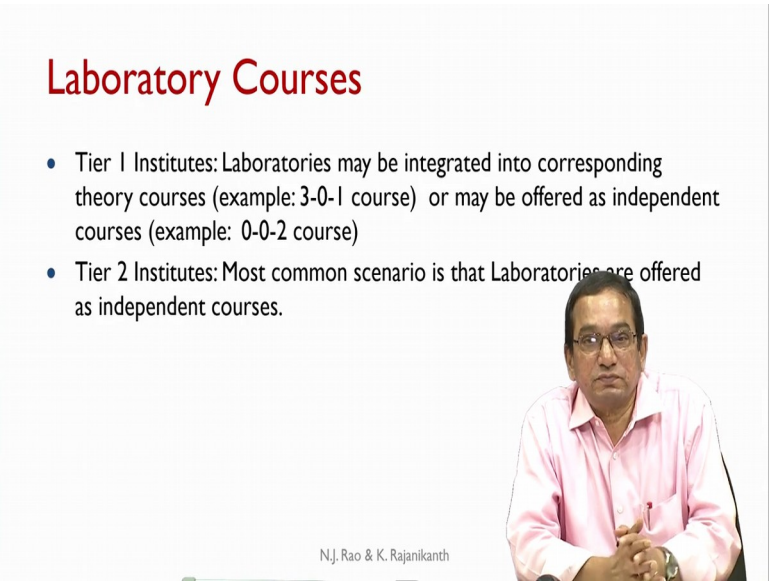

Now, the way the Laboratories are organized as well as the way the elective courses are organized - there is considerable variation across the institutes; tremendous variation in fact, with respect to both laboratories and electives. In Tier 1 institutes, the instructor has the freedom. The laboratories may be integrated into corresponding theory courses. That means, single course with a single course code. For example, the credit structure may be 3:0:1; that means, three hours of theory, no tutorials and one credit of laboratory work, which typically translates to two hours of work per week. So, the theory and the corresponding laboratory are integrated into a single course and there is a single grade which is finally awarded with respect to this course.

Or it may be offered as an independent course. Example: 0:0:2. That means, there is no theory, no tutorials, only laboratory work worth 2 credits; that means, four hour per week. This is a course by itself and it is awarded a grade. So, the grade is awarded based only on the laboratory work. The laboratory course is offered as an independent course.

Both are possible. Tier 2 institutes: Most common scenario in India at present is that laboratories are offered as independent courses. That means, typically no theory, no tutorials and only the laboratory credits are existing and that becomes a course by itself and is awarded a grade. The corresponding theory is taught in a course, which has the different course code. It is not that there is no corresponding theory, but it is a distinct separate course with a separate course code and grades are awarded separately for the theory part and for the laboratory part. So, the laboratory itself becomes a course by itself - that is the most common scenario in Tier 2 institutes.

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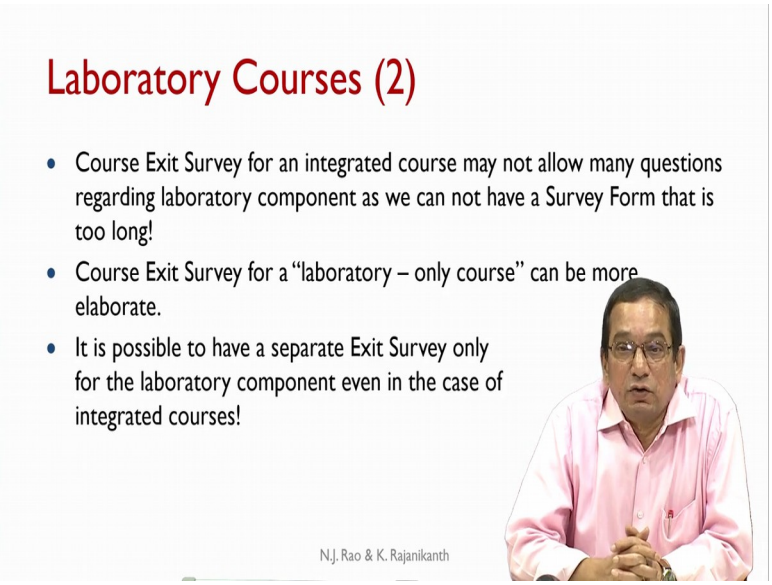

If you have an integrated course; that means, both theory and laboratory combined; then the Course Exit Survey may not allow too many questions regarding only the laboratory component. The reason is that we have already certain questions regarding the theory part. Then the number of questions that we can ask regarding the laboratory part may not be many, because, over all survey form has to be of certain limited length! We cannot have survey form in which there are too many questions; as we already have seen that that is not a good design.

The Course Exit Survey for an integrated course may not allow many questions regarding the laboratory components, as we cannot have a survey from that is too long. On the other hand Course Exit Survey for a laboratory-only-course can be more elaborate; you can have more questions.

Even for an integrated course, it is possible to have a separate Exit Survey only for the laboratory component, because we are essentially using the Exit Survey to gather data which can be used to improve the implementation of the course in the next time. So, nothing prevents us from having a separate Exit Survey only for the laboratory component, even in the case of an integrated course. In fact, if we do that, we have the advantage that we can get more detailed data regarding the laboratories.

So, it may be desirable even if the course is integrated course, to have a separate Exit Survey only for the laboratory component.

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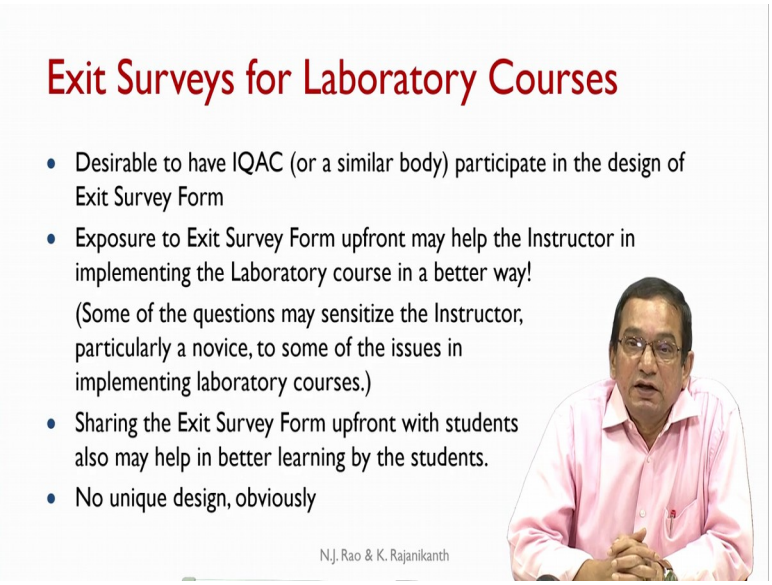

So, when we are designing the Course Exit Surveys for the laboratory courses, it may be worthwhile having IQAC participate in the design of the form, the Internal Quality Assurance Cell or some similar body which exist at the institute level. If that body participates in the design of Exit Survey form there are certain advantages. Exposure to the Exit Survey form upfront may help the instructor in implementing the laboratory course in a better way.

It looks a little bit peculiar, but basically the exposure to the survey form would help sensitize the instructor to the issues that are involved in good implementation of a laboratory course. Such an exposure itself, particularly for a novice, would be very helpful in implementing the laboratory course in a better fashion. So, some of the questions may sensitize the instructor, particularly a novice instructor, to some of the

issues in implementing laboratory courses and that would help probably in implementing the laboratory course in a better fashion. Sharing the Exit Survey form upfront with students also may help in better learning by the students, again by the same logic; by exposing the students to better way of utilizing the laboratory experience.

So, if we can design an Exit Survey for the laboratory courses up front and share it with faculty and students, it has some positive impact on the learning as well as the way the laboratory course is implemented. Obviously there is no unique design. We have to experiment and see what works best in our specific context.

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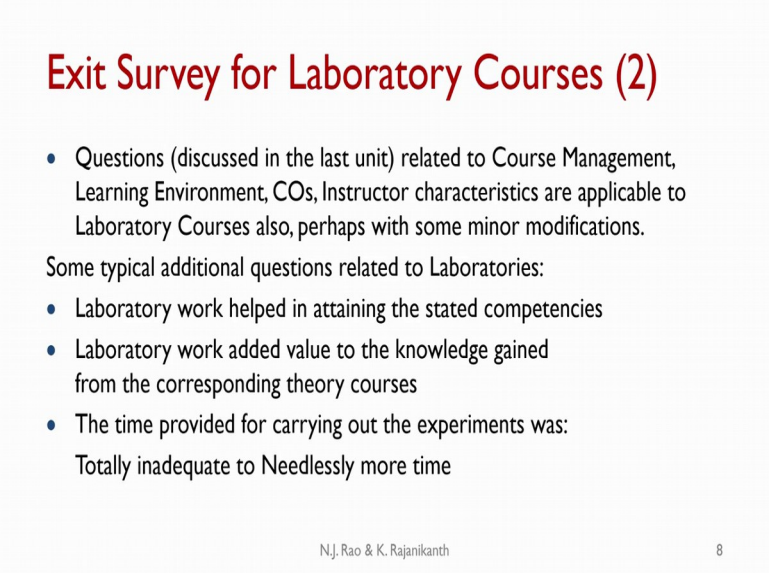

Questions which were discussed in the last unit related to Course management, Learning Environment, Course Outcomes, Instructor characteristics are all applicable to laboratory courses also; perhaps it is some minor modifications where required. But some typical additional questions related to laboratories that we can ask, would be: “laboratory work helped in attaining the stated competencies”; “Laboratory work added value to the knowledge gained from the corresponding theory courses”. The theory course gives certain kind of knowledge, skills and attitudes to the student. The laboratory work - does it add any value to that or whether it just simply repeats whatever has been learnt in the theory class.

“The time provided for a carrying out the experiments was totally inadequate to needlessly more time.” Now this information would help us to plan the laboratory

utilization in a better way when the course is offered the next time, particularly in tier 1 institutes, because in tier 2 we may not have great freedom.

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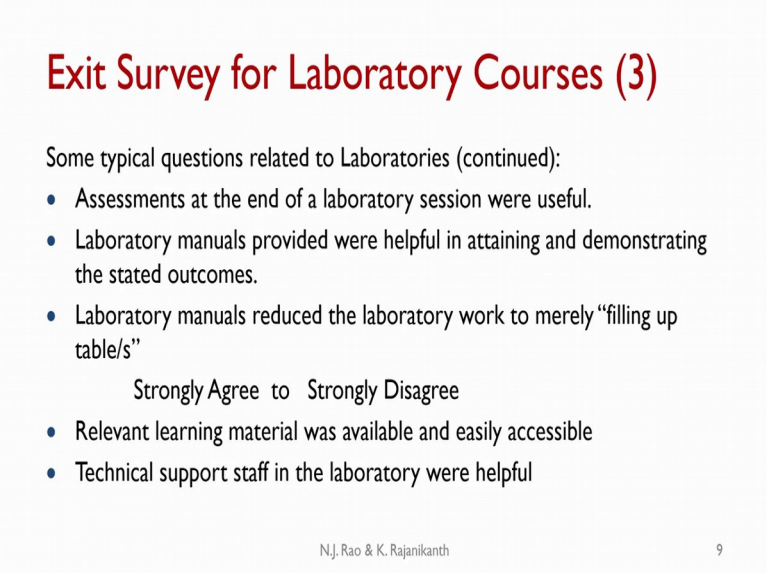

"Assessments at the end of a laboratory session were useful" - As a part of the NBA requirement also it is required that at the end of every laboratory session the students performance needs to be assessed and recorded. These assessments help the students know the outcome of that particular experiment as well as may be some other attributes and skills that are required. These assessments at the end of a laboratory session - were they helpful to the students or were they just mere routine questions?

Then another important area is laboratory manuals. We can ask several questions regarding them. So, some possible questions are: "laboratory manuals provided were helpful in attaining and demonstrating the stated outcomes"; "Laboratory manuals reduced the laboratory work to mealy 'filling up the tables'". In some institutes, the laboratory manuals are so elaborate that there is nothing left for the student to learn as such! The whole setup is clearly written or in the case of programming laboratory the entire program is given. The student merely types in the program. Or, in the case of some other experiments, everything that needs to be done - micro steps - are detailed in manual. The student merely, in a route fashion, repeats whatever is given in the manual. And tables are also printed; all that the student has to do is just note down some value and fill it upon the table - practically there is no learning involved.

So, if that is the way the laboratory manuals are prepared, probably they would not really help the students to learn anything in the laboratory work. And many of the students actually may not like that kind of laboratory manual which does not help them to explore experiment or learn anything new. So, you could ask a question: "laboratory manuals reduce the laboratory work to merely filling up the tables". In fact, such a question, if it is there in the exit survey form, an instructor conducting the laboratory would also be sensitized to this issue.

So, the very fact that such a question is there in the survey might sensitize the instructor to revising the laboratory manual. So, we can ask this question and (response can be) strongly agree to strongly disagree. "Relevant learning material was available and easily accessible." The related user manuals help manuals, the equipment manuals - they are all easily available and accessible. "Technical support staff in the laboratory were helpful" - that is also another question that we can ask.

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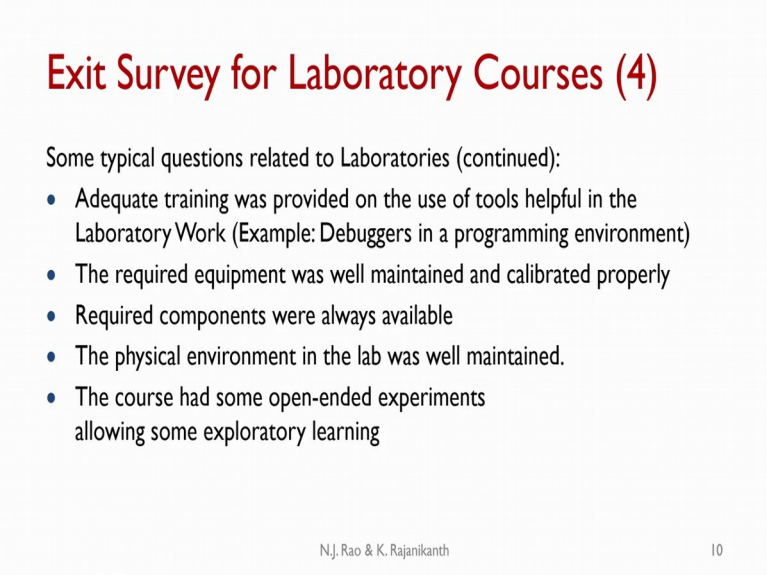

"Adequate training was provided on the use of tools helpful in the laboratory work." Now often it happens that the laboratory work is not planned as carefully as the theory work.

The tools which would make the laboratory learning experience better would not receive adequate attention. Students are not trained well in the use of these tools and this leads to low quality learning by the students. For example, in a typical programming environment

(particularly in the first year. In fact, most of the institutes have in the first year a programming course may be based on C language; sometimes it is based on Python or JAVA, but typically most of the institutes do have a programming course in the first year.), while the language is taught, the specific execution environment or development environment is familiarized to the students. Often the associated debugging tools are not really given enough importance. The students struggle by trial and error; they try to correct the programs. But in a formal way the introduction of the tools which would help debug the programs efficiently are not really learnt by the students; the instruction also does not explicitly provide for such training.

So, we could ask the question: "adequate training was provided on the use of tools helpful in the laboratory work." Similarly, in several departments in the electronics related areas, there are good instruments like logic analyzers, in circuit emulators! But they more or less remain locked up in the shelves. In the regular laboratory works, these instruments are not really made use of. Students are not given adequate training on the use of these tools and in fact, sometimes no training at all on the use of these tools and the learning quality suffers because of this. Even though resources are available they are not utilized properly. So, we can ask a question "adequate training was provided on the use of tools helpful in the laboratory work." Again as I mentioned, having this question itself in the survey form, may trigger both the faculty and students to explore the possibilities of using such tools in a more effective fashion.

"The required equipment was well maintained and calibrated properly." Primarily this would show up in the experiment not leading to valid results. And if the student is perplexed, the laboratory support staff or the instructors, when they examine the data - they in general find out that there are problems with the equipment. Those students who have conducted the experiment properly and recorded the data properly, the results are invalid, not because of any error on the student's side, but because of the problems with the equipment - either their calibration problems or some other issues.

So, that is how the student would come to know that the equipment was the one which was giving the trouble. So, we can ask the question: "required equipment was well maintained and calibrated properly." In fact, in the accreditation, this is one of the essential criteria - that the equipment is regularly serviced and calibrated periodically as required. So, there must be an appropriate preventive maintenance schedule by the

department. That is also requirement from that side, but from the students' learning side we can ask this question that "the required equipment was well maintained and calibrated properly." "Required components were always available"; "the physical environment in the lab was well maintained - Conducive"

"The course had some open-ended experiments allowing some exploratory learning." This again is more easy in a Tier 1 institute. But in a Tier 2 institute also, it is possible to provide this kind of learning experience to the students. Most of the time, the laboratory experiments are totally well defined and the outcome is also well known and the students are expected to simply carry out the experiment to ensure that the stated outcome is achieved. But it would help in learning well by the students if some of the experiments do not have any well defined outcome; but they are more exploratory in nature.

So, the students - if they get an opportunity to conduct some of the experiments in a slightly open ended fashion, it may create certain excitement as well as better learning by the students. So, is there such an opportunity given? So, we can ask the students: "the course had some open ended experiments allowing some exploratory learning."

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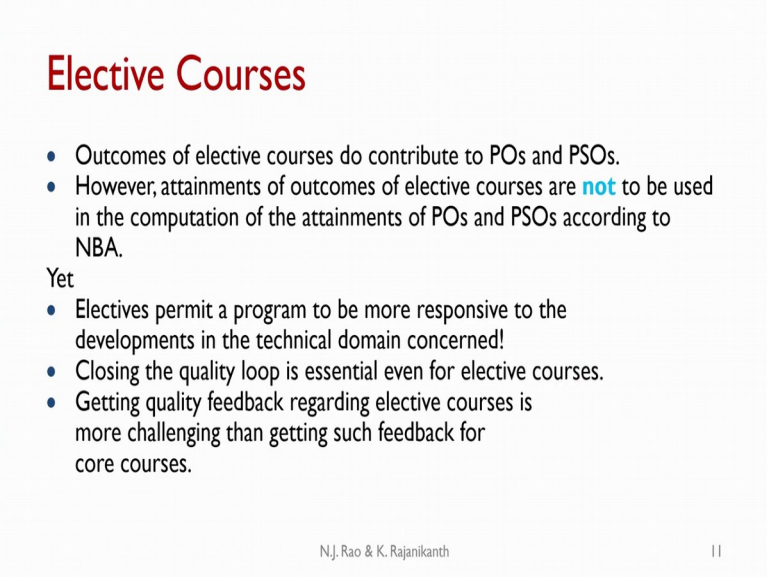

So, these are some of the questions that we can ask with respect to the laboratory courses, in addition to the typical questions that we already covered with the Course Exit Survey for the core courses.

Now let us look at the elective courses. The outcomes of elective courses do contribute to the attainment of program outcomes and program specific outcomes; there is no doubt about it! However, the attainment of outcomes of the elective courses are not to be used in the computation of the attainments of program outcomes and program specific outcomes according to NBA. NBA insists that the attainment calculations for POs and PSOs be based on the course outcomes of only core courses.

This leads to, probably, a scenario where the elective courses are somehow looked at as not that very important from the quality perspective. (Not always, but in some cases. In some institutes and with respect to some faculty the elective courses may not be treated seriously, because their outcomes are not being used to compute the attainments of the POs and PSOs.) But it is very important to note that the outcomes of elective courses do contribute towards program outcomes as well as program specific outcomes. And in fact, electives have special characteristics - they permit a program to be more responsive to the developments in the technical domain concerned because electives can be offered much more easily, much more frequently in the curriculum, compared to the core courses. So, they allow a program to be more dynamic and responsive to the developments in the technical domain concerned. And closing the quality loop is essential even for an elective course. Even with respect to elective course, it is important to get the feedback data and plan for improvements in the implementation of the course the next time it is offered.

So, we must set targets for the attainment of COs. We must compute the actual attainment of the COs and if there are gaps we must plan for improvements. So, getting the feedback data from the courses is as important for elective courses as for core courses. So, getting quality feedback regarding elective courses is more challenging than getting such feedback for core courses. We will see some of the peculiarities of elective courses, but it is very important to get the feedback data even for elective courses.

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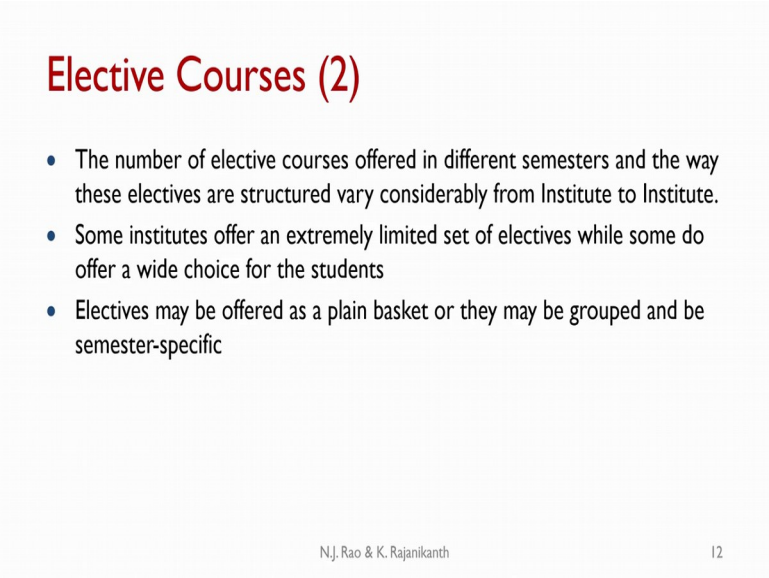

Now, what are the complexities with respect to the elective courses? The number of elective courses offered in different semesters and the way these electives are structured vary considerably from institute to institute. In fact, enormous variation exists with respect to elective courses. Some institutes offer an extremely limited set of electives while some do offer a wide choice for the students. In fact, in some cases, there is a joke that the elective is for the department - the reason is that even though there is a set of elective specified in the curriculum, the department may offer only a single elective.

So, effectively it becomes core for the students. But some institutes do offer wide choice for the students. Electives may be offered as a plain basket; just simply a list of ten, fifteen courses is provided to the students and students can pick up any from this list. Or, they may be grouped and be semester specific, in the sense that in one semester I may say there are two elective groups and in group one these are the courses and in group two these are the courses. So, the students has to pick up exactly one elective from first group and exactly one elective from the second group; that means the electives are grouped and these groups are very semester specific. One particular group is offered during one semester only.

So, it is possible that this is how the electives are organized.

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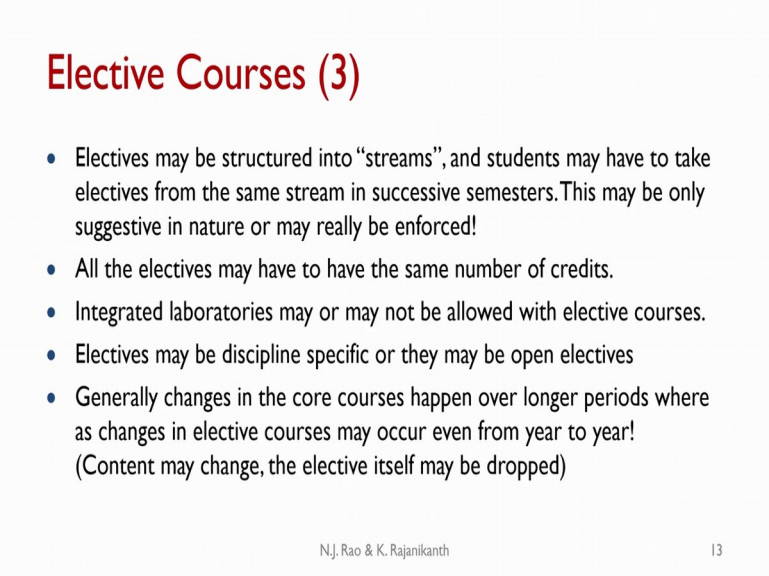

Then it is also possible that the electives are structured into streams. In the sense that, the electives are related to each other in subsequent semesters and students may have to take electives from the same stream in successive semesters. For example, if this student picks up one elective from (let us say) image processing and pattern recognition stream, in the next semester, the student is supposed to pick up another elective from the same stream.

So, some institutes actually insist that students must select like this in a stream only. In some institutes even though streams exist that may be more suggestive in nature and students may have the option of breaking from the stream. All the electives may have to have the same number of credits. Many institutes impose this restriction and that is from the convenience of administration of the program. All the electives are 3:0:0, or, all the electives are 4:0:0. Like this, institutes impose restrictions on the credits that an elective may have. In some institutes the electives are not supposed to be having any integrated laboratories. All core courses have variable structures and all elective courses have identical structure. Every elective must be necessarily 3:0:0; that is how the may specify. That means, no integrated laboratories we will be allowed with elective courses. In some cases they may allow.

Electives may be discipline specific or they may be even open electives. Students can choose to opt for electives offered by other departments. These electives are normally

more to broaden the scope of the learning by the student; to give wider perspective. For example, a computer science student may opt for an elective that is being offered by mechanical engineering department; such an open elective is possible.

Also, another aspect is that generally changes in the core courses happen over longer periods. Typically once the core courses are finalized, at least one batch of students is expected to come out with the same structure, i.e., four years; then only a change in the core course is contemplated. But changes in the elective courses may occur even from one year to the next year. They are much more rapid. New electives may be offered and old electives may be dropped, content may change, many possibilities are there with respect to the electives.

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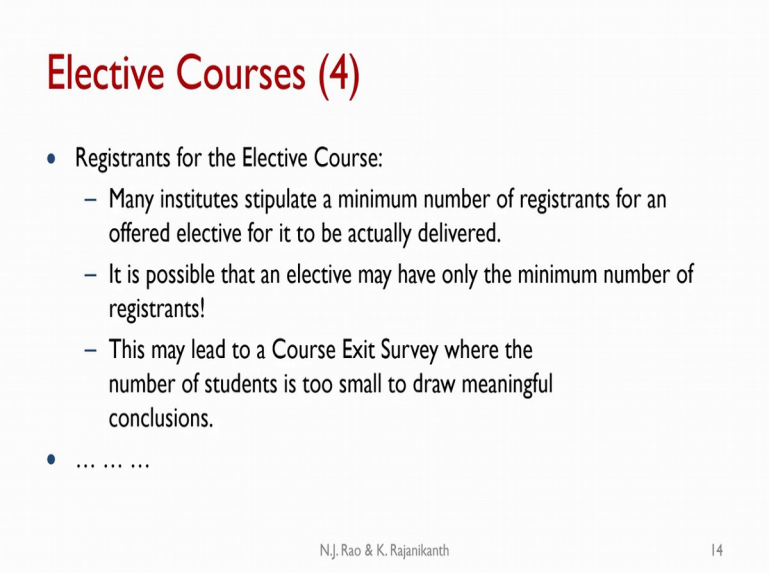

The number of students who register for the elective courses: The registration for the elective courses - many institutes stipulate a minimum number of registrations for an offered elective for it to be actually delivered. That is, at the start of the semester, the electives proposed to be offered by the department are listed and the students register for them and unless there is certain minimum number of registrants actually, what is given in the initial list may not really be implemented.

So, this stipulates a minimum number of student registrants, for an elective to be actually delivered. It could be a small number like 10 or 15, whatever be the number. And it is possible that an elective has actually only that minimum number of registrants. The

implication is that the number of students who have registered for that elective is very small. And if that happens, the Course Exit Survey would be having feedback from a very small number of students. And thus, to draw meaningful conclusions may be very difficult. And from a very small set of students you have, getting valid data becomes more challenging; we will discuss what to do in such cases.

But these are all the possibilities that exists; only some. In fact, there are many other variations because of which the design of the Course Exit Survey for an elective course has it is own peculiar issues.

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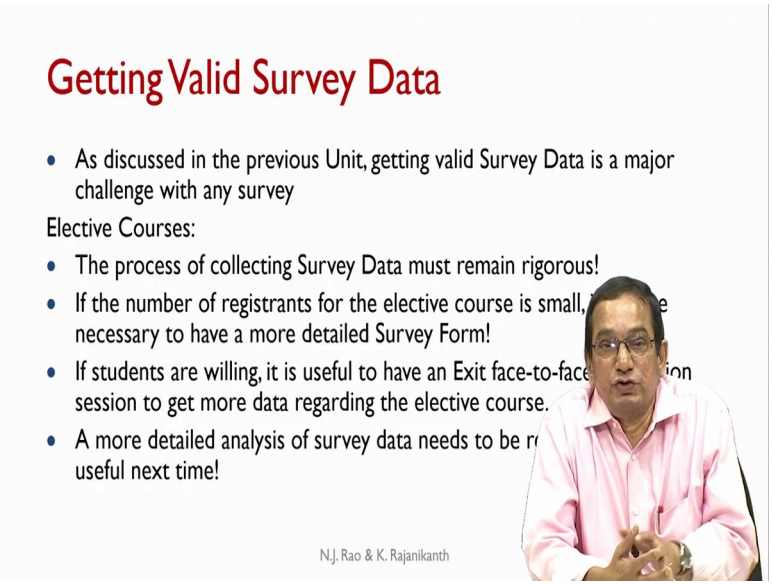

Getting valid survey data, as we already mentioned, is extremely important and that is a major challenge even with respect to core courses. But with respect to elective courses, it becomes much more challenging. First thing is that even though the elective courses are not being used to compute the attainment of POs and PSOs, the process of collecting survey data must remain rigorous. Electives must not be treated as something with which we can be loose with respect to the quality aspects.

So, the process of collecting survey data must remain as rigorous with elective courses as with core courses. If the number of registrants for the elective course is small, it may be necessary to have a more detailed Survey form. Because the number is very small, we may not able to get meaningful and valid data unless we ask more questions; questions in greater detail to extract more information, so that we can draw valid conclusions from

this survey data. If the number of registrants for the elective course is small, it may be necessary to have a more detailed survey form.

If the students are willing, in fact, it may be very useful to have an exit – face – to - face interaction session to get more data regarding the elective courses. If the number is small, the instructor usually has a more easier one-to-one kind of interaction possibly. And if the students are willing, the instructor can have a face-to-face interaction during the Course Exit Survey and try to get additional data. What is revealed in the anonymous survey data is fine, but in addition, one can have an exit – face – to - face interaction to get more data.

And a more detailed analysis of survey data needs to be recorded for it to be useful next time because next time there might be minor changes in the contents of the elective course. So, the analysis of the survey data must be specific to each CO, so that next time, even if there are minor changes, we can use a large part of the information gathered from the survey data. The conclusions are still useful for the delivery of the elective next time it is offered, even if there are some changes.

So, a more detailed analysis of survey data needs to be recorded for it to be useful next time. Of course, if there are no changes in the elective course which is offered the next time, then it is fine. But a more detailed analysis would help the data to be useful, even if there are some minor changes in the elective course.

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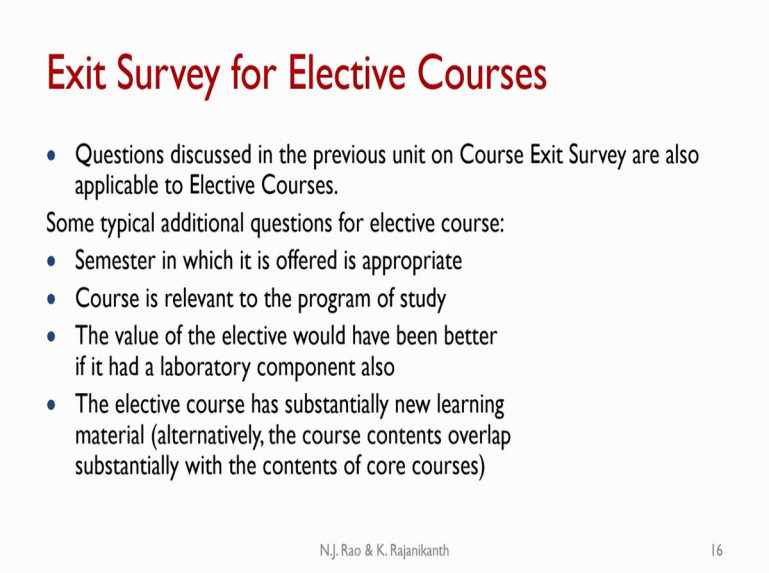

The actual Exit Survey for the elective courses, if we look at it - all the questions discussed in the previous unit on Course Exit Surveys - are also applicable to Elective Course. But some typical additional questions which are possible for elective courses - we can discuss.

“Semester in which it is offered is appropriate”: As I mentioned, some of the electives are semester specific. So, if it is offered in a particular semester, do the students feel that, that is an appropriate one? This can be with respect to the prerequisite knowledge that this elective course assumes; whether it is already covered in the earlier semester. And the sophistication of the elective course - is it consistent with the maturity level expected from the students at that semester. So, from all these considerations: “Is it appropriate - the semester in which this elective is offered - is it appropriate?” Or, if the students feel that it must be offered in a later semester or earlier semester, we could get information on these aspects.

“Course is relevant to the program of study”: If it is particularly discipline specific elective, we can ask whether it is relevant to the program of study. “The value of the elective would have been better if it had a laboratory component also.” : Some of the elective courses, even though they are offered as theory courses, are actually better taught along with the laboratory. So, if the students strongly feel that a laboratory would have helped in learning that material better, then we need to plan something regarding that aspect. So, this question would allow the instructor to plan implementation in a slightly different fashion. “The value of the elective would have been better if it had a laboratory component also.”

“The elective course has substantially new learning material”, in the sense that the material provided in this elective course is something novel. Alternately we could ask the question: “the course contents overlap substantially with the contents of core courses”. Both are same essentially; both questions. The way you want to phrase it is up to you. But what essentially we are trying to say is that, if the material from 2-3 different core courses is simply clubbed together and offered as an elective course, it does not add substantially to the learning of the students. So, one can ask whether the material provided in that elective course is substantially new learning material or is it more or less what is already discussed in some other elective courses.

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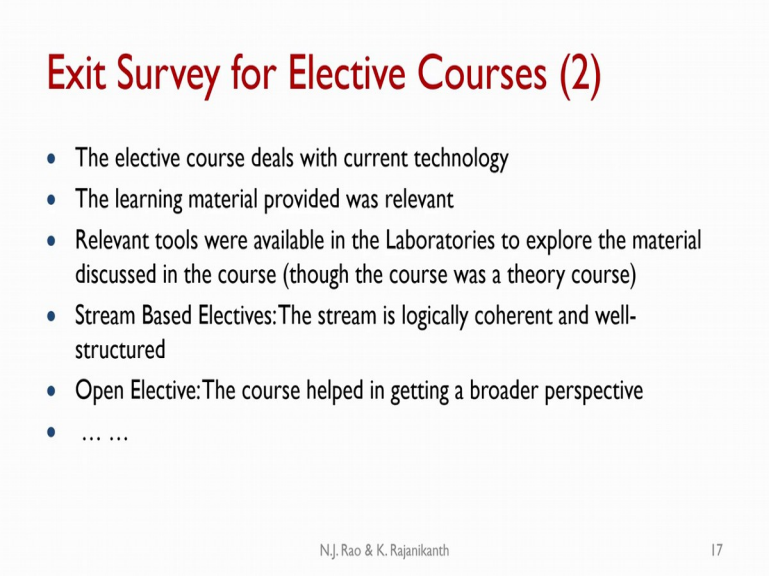

"The elective course deals with the current technology." - it is also important; deals with the latest issues, latest developments in the technology. "The learning material provided was relevant" - particularly if the elective is with very recent developments in technology, the learning material may not be that easily accessible or available to the students. So, it is important to know whether the learning material provided was relevant and easily accessible.

Even if a course is offered only as a theory course as just now we discussed, learning may be better if some kind of laboratory experience is provided to the students. So, even if a course is a pure theory course, it is possible to have certain demonstrations in the classroom even, of the appropriate laboratory experiments. Or, it may be helpful if the students are taken to the laboratory and some of the topics are elaborated through appropriate laboratory experiments. If that is the scenario, whether "relevant tools were available in the laboratories to explore the material discussed in the course?" If it is an integrated course, obviously, the relevant laboratory will be there. But even a pure theory course - like a 3:0:0 course - may benefit from having certain possibility of exploring the material in the laboratory. And if relevant tools are available, that may help the students learn the material better. So, we can ask the question: "whether relevant tools are available in the laboratories to explore the material discussed in the course", though the course was a theory course.

In the case of steam base electives, we can ask whether the stream is logically coherent and well structured. Early part in the stream, it may be difficult for students to provide valid and useful data; but if it is the last elective course in the stream, then the students may be in a better position to give their opinion regarding whether the stream is logically coherent and well-structured or not. And with respect to open electives, we can ask the question: "the course helped in getting broader perspective". Again, it can be on a rating scale of 1 to 5. So, this in general, will give us an indication as to in what way the open electives are being used by the students; to what extent they find them useful.

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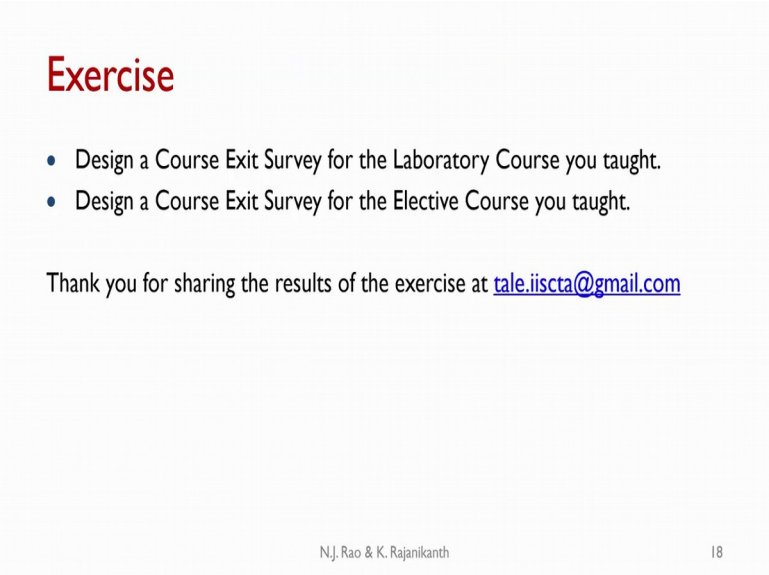

So, these varieties are possible.

Exercise: Design a Course Exit survey for the laboratory course that you taught. Design a Course Exit Survey for the elective course you taught.

Thank you for sharing the results of the exercise at tale.iiscta@gmail.com.

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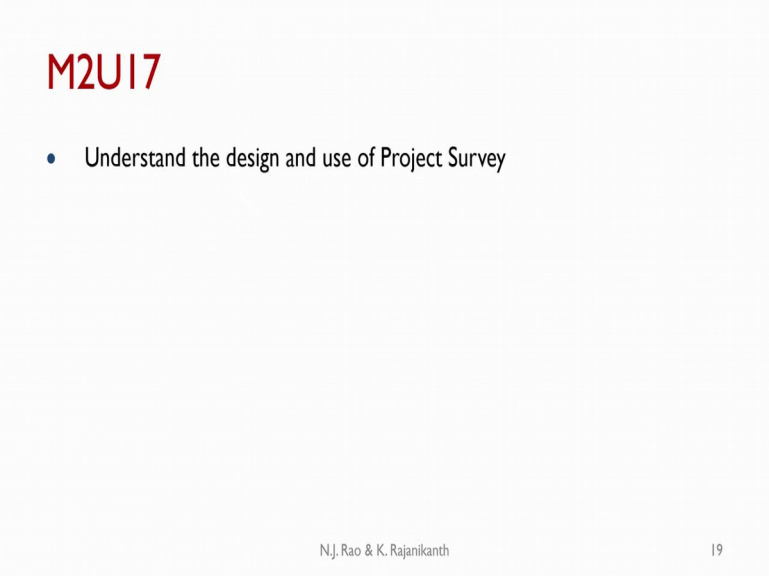

In the next unit, we will look at the project; understand the design and use of project survey. Again the Course Exit Survey that we discussed for core courses with some changes, with some additional considerations can be used for elective courses and laboratory courses and when it comes to project certain additional considerations do come in to the picture. So, in the next unit, we will see how to design and use in Exit Survey form specifically for final year projects.

Thank you.