Learning Analytic Tools
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Lecture No. 1.3

Four Levels of Learning Analytics

Welcome back to Learning Analytics course. So, I mentioned in a couple of videos ago that LA can be also defined as applying analytics on learning data. If we take that definition, consider that, analytics is another circle and if you are applying analytics on learning data that can be called Learning analytics.

Let us focus on that definition and start applying that definition in our course. Hence, we can apply the types of data analytics in learning analytics also. So, we organized our course by considering the types of learning analytics, then in each week we describe each type and we will work with a demo and data collection in each type of data analytics. What are the types of data analytics?
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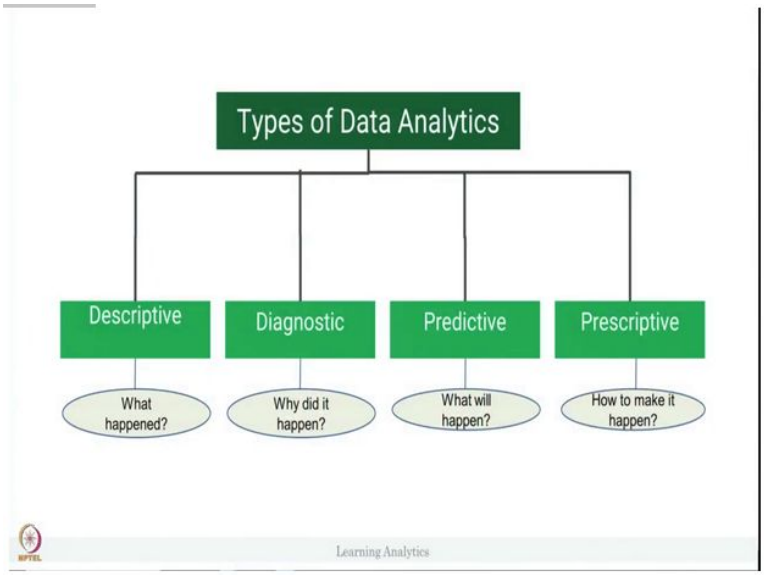

There are 4 types- descriptive, diagnostic, predictive and prescriptive. You might know these types if you have done some data analytics or statistics courses, there are different names, but these are the basic types in data analytics. What is descriptive? Descriptive is like, what happened?

So, from the data, what happened will be described by tables or charts or written words or some graphs or something like that. From this data asking “Why this happened?” is diagnostic. And if you know why it happened, asking “What will happen next?” is predictive. And if you know what will happen next, can we change the learner outcome, can we help the learner to achieve his goal, can we make it happen like what we want it to happen, like what we want learners to learn? So, let us briefly describe these 4 terms.

And in this course, every week we will talk about one type of analytics. Assume that you are going to a doctor and the doctor asks you first question “What happened to you?” So, you describe your symptoms. So, describe is basically when you are describing what happened to you. And based on that, the doctor is asking other questions.

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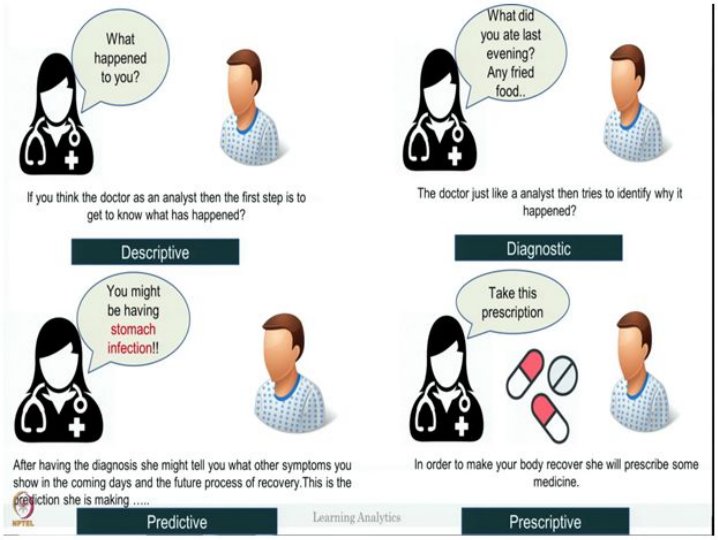

“Why it happened? Did you eat anything last night or did you have milk with the coffee? Whether you had some fried food?”

So, based on that information, he is comparing your symptoms with other information you might have given, the doctor is trying to come up with a model and trying to say why it would have happened? So, it might have happened because you might have a stomach infection or you might have a fever. So, doctors already have a model for each symptom and other indicators, there are such types of causes if you have a stomach ache, you might had some bad food or

stale food, you might have a stomach infection or you are having fever or something like that.

So, doctors have basic data about you and also are able to predict what would have happened to you. That is a predictive model. So, based on that, the doctor will prescribe tablets for you to get well so that your body conditions get better. So, the simple analogy of LA, first you describe your symptoms to the doctor, then the doctor diagnoses it, then the doctor predicts what would have happened.

In most cases, this prediction is correct. In some cases, a prediction may go wrong, that is why in the initial screening, you may not get cured, then they go for the second test and multiple tests and try to identify the exact cause. So, based on that they prescribed some medicines for you to get a cure. So, we can take this simple analogy of you visiting a doctor or hospital scenario for the learning analytics.
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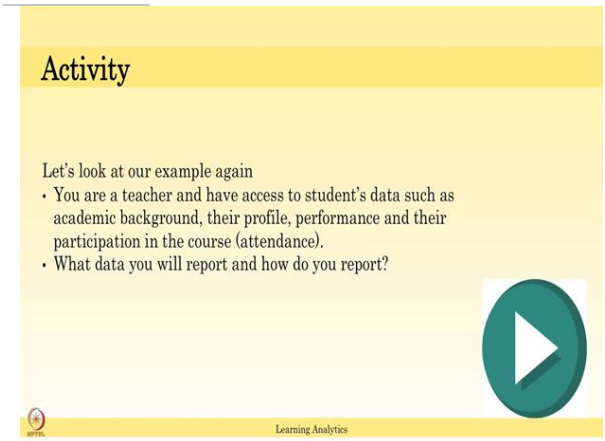

Look at how it can happen. In the first video, we had an example that you are a teacher and you are teaching the same course in the last five years to third-year students or something like that. And you have access to the students' data, such as academic background, profile, performance, whatever data you can imagine, all the data you can collect from the students in the classroom environment. So, what data will you report and how do you report? I want you to pause this video and think about what data you will report?

It's not the one class, suppose we have 60 students in year 1, and you might have taught for the last 5 years, so 300 students' data. So, suppose from 2015,2016,2017 so on. So, each year there is a different set of data for 60 students. If you take performance, that will be like

$$60 \times 5 = 300$$

300 comes up.

So, imagine this data if you are collecting more data like a performance in the midterm or performance in each question or the profile, imagine this data, I want you to think about this data. And how would you like to represent? Will you represent in a bar chart, will you represent in a pie chart, and why? Please pause this video, write down your answers. Once you write it down, resume this video to continue.

Consider you can have a lot of data like attendance, performance over years, assignment scores, the class feedback, their entry test or exit test, all this information, you might have it. So, these are the data you have over the last 5 years. Now you might represent using a pie chart.
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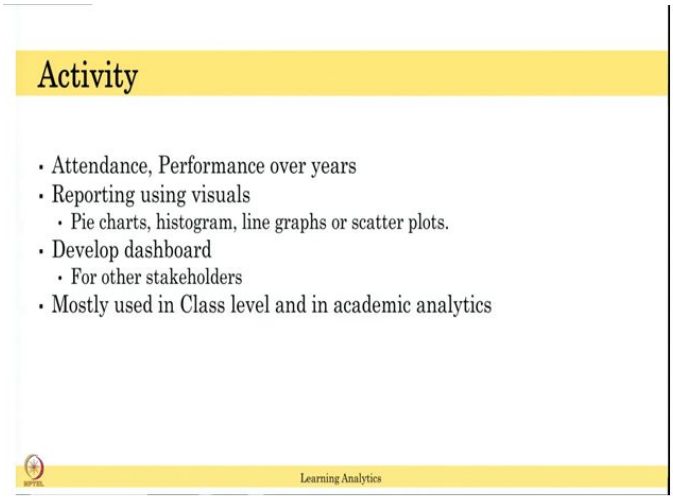

Pie chart may not be common for all the data position. A pie chart to represent what happened in a certain percentage compared to another set of data. Or histograms is a nice one. Or line graph or scatter plots, you can use a different kind of plots to represent this data. Or simply representing your data in tables is not enough because this data is not showing you the trends or this statistical information.

Or you can use plots or you can use some other graphics for representing your data. If you represent this data, this can go in part of a developer dashboard or like dashboards, where the teacher can access to students' data, students' interaction with the systems, everything can be there. And these dashboards are generally used in academic analytics, for example, for very large data.

In a classroom environment of 60, we might not use the dashboard. But if you have, say, 1000

students interacting with, say, 30 videos and they have done 3-4 exams and a lot of questions, then dashboard is better.
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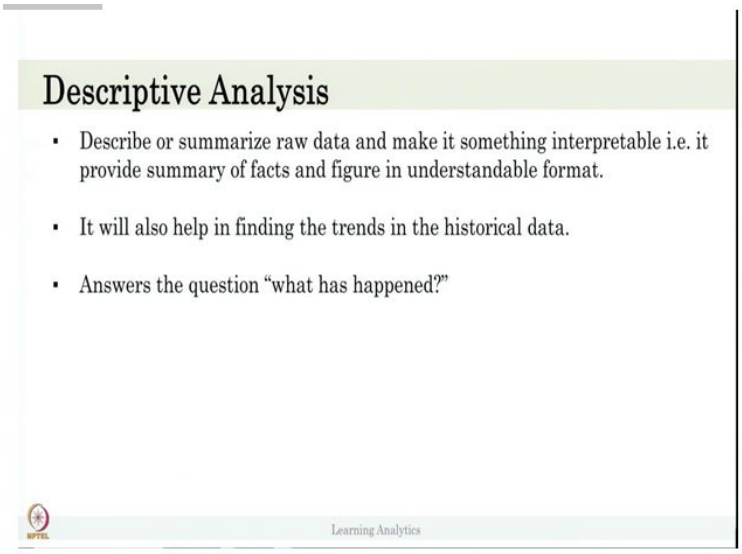

So, what is descriptive analytics? It describes or summarizes the raw data and make it something interpretable like you have to represent all the information of the data in a single picture and it also provides the facts and the summary of the data in a single slide or a single image or single picture. And it is easy to understand by different stakeholders, this is how you have to describe the data.

It will also help in finding the trends in the historical data. If you have the past 5 years of data, you might say, the students in 2018 did not do well in the exams compared to other groups. You might have reasons, why it happened. And this describes, descriptive analytics data, the graphical representation, should answer what has happened. If someone asked, "What has happened in 2018 exam score?" You can just simply look at the graph and say, "Yeah, 68 per cent students passed with more than 80 marks, something like that."

So, this descriptive analytics should tell what has happened from checking the tables or figures or some other visual representations.
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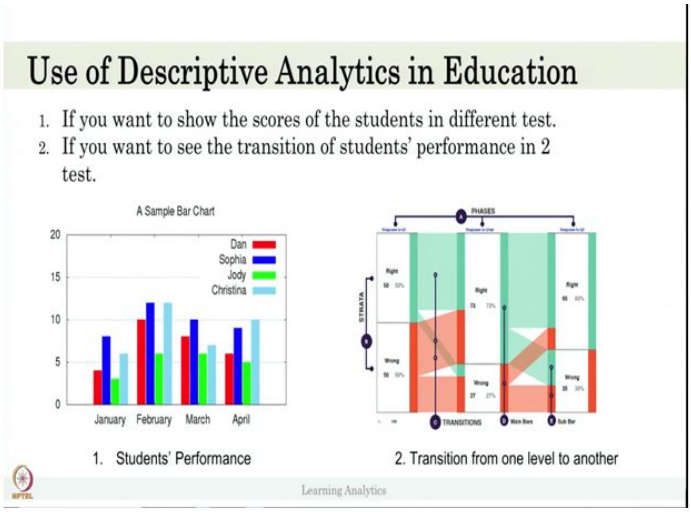

If you want to show the scores of students in different tests, so you can use the descriptive analytics, for example, say there are 4 four students and they have taken a test each like January, February, March and April. You want to show the students score for last 4 months and you want to compare amongst them, you can show a simple bar graph. Or you want to see the transition of students' performance in two tests.

For example, you conducted an entry test and exit test and you want to show the transition of the students' performance over entry test to exit test. For example, the group of students who got the score and they might have got a better score or least score in this test. So, this kind of transition also can be represented using stratified diagrams. This diagram is created using a tool called ISAT and we will talk about this tool in a third or fourth week of our lecture.
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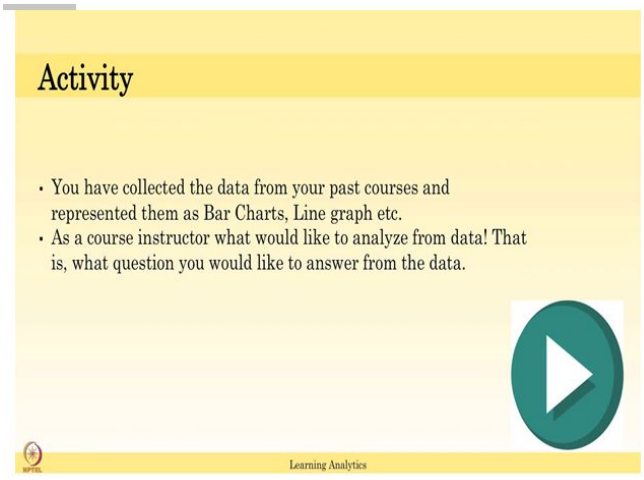

So, let us move on to the next topic, the next type of analytics. Now, you have collected the data from your past course and also you decided how to represent them, as a bar chart or line graph.

And you know, what data you want to present. As a course instructor, what you would like to analyse from this data? Like what question you want to answer from this data? As I mentioned, suppose you see at the 2018 year, the performance of students in your class has decreased compared to other years.

What question do you ask? “Why that particular year's performance has been down?” How do you answer that? Please write down your answer in a paper, pause this video. After writing it down, resume the video to continue.

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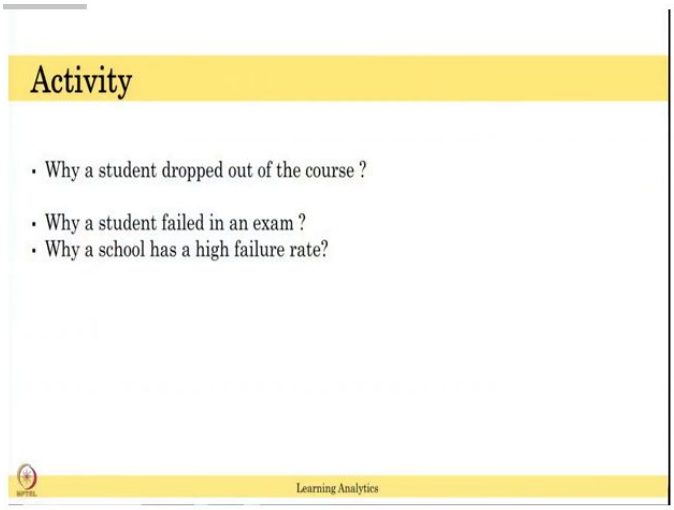

So, you can ask questions like, “Why a student dropped out of the course?” or it is one particular question. Or “Why a student failed in an exam?” Like, that the student might have failed in a particular exam, why the student say, fail in the exam? Why a student has a high failure rate or why school as a failure rate. For example, a school in a district A has a very high failure rate, their performance is very poor. Why that school has a very high failure rate?

So, diagnostic analytics is actually, you start looking at why it happened, why this particular school or a particular year or particular student is not performing well or why the student is performing really great, why the school is achieving 100% success all the time. Then, you might need to collect other variables associated with that and you might do correlation, regression on that.

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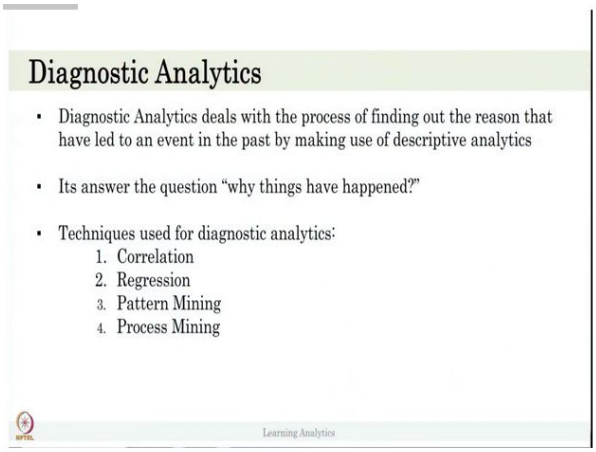

So, what is diagnostic analytics? Diagnostic analytics deals with the process of finding out the reason that leads to an event in the past by making use of descriptive analytics. From the descriptive analytics data, we are trying to find out, “Why it has happened? Why this particular case, why, what is the reason behind this diagnostic analytics?” It answers the question of why things have happened.

Then, it also says that why things have happened in this way compared to the other ways, suppose you were teaching 2 classes or 2 subjects in the last 3 years. In 2018, the same set of students, who would have done better in one subject, but bad in another subject, why things are happening in one way compared to the other way in other classrooms?

So, you can have a lot of questions coming from the “why”. So, what we do? We basically apply some techniques for diagnostic analytics. For example, correlation. Suppose consider that in your class in the year 2018 batch, students performed really bad, you can correlate performance with the students’ attendance rate. If the students’ attendance rate is correlated with the performance, you know that the students have a poor attendance rate in that particular year or there are a lot of holidays in that year, so the student, they were not able to come to class and you were not able to teach, cover the topic. So, their performance has gone down, that is one chance.

Or if you have multiple variables like the student assignment scores, or you know that the sports meet happened in that particular year or the attendance rate, the background information, profiles, you have multiple information, then you can run a regression analysis. Or you can do a pattern mining if you're using the environment like a technology-enhanced learning environment, instead of a classroom environment.

If you know the students are interacting with the system in a fixed set of time like they are reading and they are doing some analysis, they are interacting with the simulator, they are answering some questions, if you know the students' set of actions already in intelligent learning environments, then you can collect this data, actions' data, then you can run a pattern mining. Or you can also apply the process mining on this data.

This will answer the question of "Why something happened?" That is called diagnostic analytics. So, in this video, we saw a couple of things.
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One is descriptive analytics and diagnostic analytics. We will describe each of this in detail and the tools we mentioned in this video in the coming weeks. Thank you.