Multilevel models for clustered continuous outcomes, part 3—2010 MCH EPI pre-conference training workshop

SUBHASH ARYAL: -continue from where we stopped previously. Some of you have come to me and told me to do a few things differently, slow down, do this, so if you have, again, questions, comments please just raise your hand and tell me to do these things differently. If I have to stop, go back again, please let me know because my goal is not to cover all the slides, but whatever we cover so that when you go and starting on a thing you should be able to do it other than me trying to go over everything and then it's going to be a waste of time for you, so don't hesitate to interrupt please.

[Comment]

In some of it, it may be observational studies also. It's not going to be a randomized study, right. You may be looking at some of these things, but usually some of the things that I've been asked is about like doing this clustering thing where it's ****, those kind of things, so the way the data is generated in those cases it may be different and based upon the way the data has been generated, the data has been collected. Some of the assumptions that these models require may not be valid, but if you had said the data- if it's like a stratified sample that you are analyzing, the stratified sample that you have generated in some of those cases even if it's survey data this may still be useful. This may be appropriate to use, but some of it, it may depend upon how the data has been generated.

[Comment]

So in that case you may have to look at the data more clearly before you can say that whether this matter will be appropriate or not, but from as far as I understand, even for doing some of these survey data that want to use mixed models this may be the only method that is available, so you may have to relax some of the assumptions that we are making about the data collections and say that okay these are the shortcomings of our **** that we have and there may be people who already have- who may have already developed some of these methods or who are in the process of developing it, so that may come a little bit in the future also.

[Comment]

In those cases I think you should be able to use some of these methods because from what I've seen is like this suicide thing, this black box warning and the suicide one of the quarters in this book, Dr. Hedeker he has done extensive work on this suicide thing where he looked at like this suicide for **** data that has been aggregated like this, **** data aggregated over State level data and it's from these databases that they found out how many people, what was the number of

prescriptions that were given in that area and what is the rate of suicides that for those data **** use the **** model, so for those kind of data you should be able to use these things, but whenever you are doing those kinds of analysis things are becoming more and more complicated now when you are aggregating data at the higher level and then trying to put all of these different labels, but usually for these multilevel models by design if the data is going to be in these different levels and you are aggregating the data you should be able to handle it. It does not always have to be- The individual does not have to be the lowest level. It may be something higher than the individual and you are trying to look at the affect of higher level variables on the individual how it is going to be. You should be able to do it for those things also. Anything else? Let's move on.

Now let's look at some of the results that we did. Actually we have discussed these results already for before we broke for lunch, so in this case we saw that whenever we did the analysis in two, three different ways once we ignored the levels of nesting and in some cases next we took into account these levels of nesting we saw that the thing for the **** interaction are basically when we said that they got both of those classroom curriculum and then the TV. The TV thing, all of them, all five variables were significant here. Student and class it's not significant. Student and school it's marginally significant. Again, when we did a three-level model it's not significant, so depending upon how we run the analysis things may- we may get different results out of it and that is one of the conclusions that we can draw from this data.

And the other thing that we already talked about is not just looking at these estimates, looking at the standard errors and if you do, if we focus on the standard errors for the ordinary list square thing there is a **** model. We will see that the standard errors are in most of these cases they are going to be lower than what we see for the other way. Multilevel models, .09, 11, .09., 11, .13, .16, so basically these estimates are lower because here we are assuming that the data are independent and when we assume independence and normal it is going to give us a standard error that are downward biased and if we get a smaller standard error it means this- basically this significant is the parameter estimate divided by the standard error, so if you get a small standard error that means you are going to find something significant that may be actually not significant and here we have said that these data are not independent and we are getting a much more robust estimate of the standard errors and using those robust estimates of the standard error we are seeing that in some cases things that were significant are not significant also.

Now the other thing is students more homogeneous within classrooms than school **** we are calculating the ICC and basically when you are looking at the similarity and that is natural also. If we look at students within a classroom they may be more homogeneous. They may be more similar compared to students within a big school and that is what we are seeing here from this data, .052.02. We will go to the next slide and we will see some of those things and for the three-level model basically 3.8% of the variability accounted by classroom and 1.5% of the variability is accounted by school, so basically we are about total variance. We have the variance estimate for the class, the variance estimate for the school and based upon that we can make those conclusions.

Now these conclusions are more relevant to whatever data that we are analyzing here. You're goal may not be interest- this may not be very interesting to you because your goal is not to

analyze- see what this data is telling you about how to analyze your own data, so but in this case this is how we should be doing the data analysis.

Now to calculate some of the ICCs for these things how do we calculate the ICC? This is the error of variance that we estimated. This is the class level variance and this is the school level variance. This is basically what we are getting from the three-level nested design for the three-level ICC, so if we want to look at the similarity of the students **** what amount of variability within the same school that is determined by the school, so in this case it's the school level variance by the total variance, so this is what you are getting. Similarity of students within the same classroom, so out of the total variability, what amount of variability the school and the classroom, so there is classroom and school, so the total variability, so 5%, so in school, within the same school the students are not that similar to each other, but if you look at students within the same classroom for a particular school they are much more similar. There was this .01. Here is .05. Now if you want to see how the classes are similar within the school in this case there is a high correlation, right. It's almost .3, so in this case we see that there is the schools within the-classes within the school are much more similar to each other.

Now one of the things that we use in **** analysis and some of these things is we like to use the **** R square value. Basically that is the **** amount like the amount of variability that is explained by the model compared to what is not explained by the model. So how do you determine this one? In this case we are actually looking at we are fitting two different models to find that, so we are fitting a model without any core variants, which is determined by the **** square ****, which is the variance for the normal. That means a model that does not have any core variance. It's just an intercept that model and then **** square P is the core variance for the- It's the variance f\or the model without all the core variance in it, so in this case with this- Excuse me.

So in this case when you look at it if you want to calculate the variance of **** square 1.75 this was-

[Comment]

Previous slide, okay.

[Comment]

This means there is more similarity, right. What the higher ICC means- See here it's a very low number it means. The students within the schools they are not very similar to each other, but compared to that, students within the same class in the same school they are much more similar. We are getting .05 there, right and then if we compare the classes within the school- if they're comparing the classes within the school they are much more similar because- and that is natural also that you'd be expecting from the school also, right. In this school if it's a big school let's say with less than 1,000 students the students within the school yes, all the students who go to the same school they may be coming from the same socioeconomic status, some of those things like that. There may be similar, but that is similarity is not that much, but when you go to the little bit of other thing that if the students with all the seventh grade up they may be thinking

alike compared to the eighth grade that is compared to the ninth grade, so in that case we are doing this. Now even within the same school if there are multiple classes all the seventh graders if you are comparing the classes they may be much more similar and then they may be related, right. In the future the seventh grader, eighth grader, so this is what we are getting out off this one.

And in this case if you are looking this is the variance, total variance that we get for the null model and this is the total variance that we get for the model with all the core variance in it and then what is at the level one, if you want to calculated the R square what you are going to do? It is the one with the total variance, 1.603 divided by 1.725, whatever is that number that number is going to be very close to .9, .91, something like that and in that case if you subtract that from 1 we'll get- For just one of them let's do it, so in this case what we are doing is it's 1.603 divided by 1.725 and that gives us .9292. Now if we subtract this from minus 1 you'll see that it is .0707, which is 071, right, so that is the amount, R square that we are calculating and same thing for this R square two at the second level. Again we are doing the- at the classroom level this with the core variant, without the core variant and then we are looking at that. We find the value of R square, so R square is basically explaining what amount of variability in the data is explained at the first level, which is at the student level, not much, but whenever it is at the classroom level there is much more variability is being explained.

Now same thing if we go for a three-level model. For the three-level model we basically have the variance at the level one, variance at the level two, so in this case this would be like the error variance. This would be like the classroom variance and this would be like the school variance for our model, so when you are running all of these things for the variance estimate this is the error variance in this case. Again, at the lowest level this was the variance without any core variance. This is for with the core variance and in this case you got .071.

Let's go back and see if those numbers are here. So in this case the amount of total variability where is that? 1.725, student level, so basically you have two numbers, the error variance and this one, so if you add those two numbers you are going to get 1.75 and this is the student and classes, student and schools, 1.6, 1.8. Where did it go? Let me check. **** variance **** the random **** variance 1.94 here. 1.603 ****.

Okay, the total variance in the data. We have calculated the variance by using the variance formula and in this case the error variance is 1.6020, so it's 1.6020, 1.603, so out of the total variance how much variance is explained by this model, in this full model means this is the thing, so we are adding those two, dividing this by this. This total variance for the null model is coming from the model. That is the total variance like when you have a model without putting any of the core variants in it, so if run a model without any of the core variants this is the variance that you should be getting and this is the variance, error variance that you should be getting in this case, so basically here it will be a model without any of the care variants, just the null model, so if that would be the estimate of the variance for the null model and this is the estimate of the variance from this model that has this done, so in that case once you do that analysis that 71% of the variance is explained by that model.

In this case now we put a random intercept. We put a random intercept in a model that does not have it, so basically what we are doing here is in this case we are running a model with just this random interceptor and in this case with the model **** we are not putting any of these core variants, so that would be one estimate of the variance with the null model and once you get the estimate of the variance from the null model compared to the model that this model is explaining then you are going to be getting this number. So every time we see the null model it's the model that just has the random intercept without any of the core variants and in this case also the same thing. We are running a three level nested design. In this three level nested design to get this **** square **** we are running a model with just the random intercept. If we have two random intercepts just like the way we have it here in this analysis, two random intercepts, we are going to be putting these two random intercepts, but we are not going to be putting any of these core variants, so that is the estimate of the variance for the null model that we are getting from our model and this is going to be the same thing for the full model in the sense that all the variables are already there in the model, so once we run that this is going to be the amount of variance and that is explained by the model. This 1.602, 1.602 should be coming from the model right here. 1.602 with all the core variants, so if you want to get it for the null model basically what you are doing is you are going to get rid of all of these four variables that you have in the model.

[Comment]

No, when we say the school level variance means we are looking at- we are putting a random intercept, right. Basically this is the thing for the overall schools and now we are saying that for each of the schools they are starting at different levels, different places. Okay, the question was which variance are we talking about for the schools, so in this case this is the overall for the school and in this case by putting a random intercept we are saying that some schools are higher, some schools are lower, so in this case this random **** variance for the school is telling us what is the variance in this intercept, how far above the group, how far above the **** is one school, **** and how far low is the other school, so in a sense that if you think of a normal distribution what happens in a normal distribution. Within one standard deviation 66% of the data is there. Within two standard deviations of the normal distribution there is 96% of the data and within three standard deviations of a normal distribution you have almost every data, .99% of the data, so in this case we are trying to figure out how much is the variable data that is there at the beginning point for this school, how much is the difference in the- how much is there a variability between the schools when we are starting at that time, the difference between the variability between the schools at the starting point. This is the overall thing and then we want to see how much it is different for each school for the different school at the beginning of the study.

[Comment]

Yes, between school variance. Yes, across school, so we want to look at how much- if this is the overall for the school at starting right, how much one school is separate from the other school, so that basically what happens if our normal distribution **** is satisfied within two standard deviations then 95% of the school are going to be between that two standard deviations ****, so it tells you how much is the variability between the schools there, schools here.

[Comment]

No, not within the school.

[Comment]

No, see what ICC is explaining is this like within each school- for each of those schools- What is this thing with the ICC? Well the ICC what we are actually trying to explain is within each school we have some kind of variability. What is the variance in that random intercept? This is basically explaining out of the total variability that we have here in the data how much is that variability is being explained by putting that random intercept for the school. We are explaining some of the variability for that school, so what it is doing is it is telling us how much they are similar to each other, within each school how much are those schools similar to, how much are the students similar within the school and then ultimately with the variance, by putting a random intercept in our model what we are trying to accomplish is that we want to see how much variability is there between the schools. If the random intercept variance is basically **** we don't need a random intercept. All the schools are very- We can use just instead of having 100 lines for the 100 schools we can just use 1 line or 1 starting point for all the schools and then we are going to be fine. That is how you should be looking at it. Did I confuse you more or-?

[Comment]

And the total variance, yes. See in this case here you have this total variance, this error variance is the- within variance the error is whatever you can't explain for the same school and the variance that you can explain- between variance is whatever you can explain that kind of variance, so in this case you are basically looking at the variance of this variance over the total amount of variation that you are getting and the denominator is the variance that is explained variance and the unexplained variance is because the- This is the residual variance. Residual variance is basically the unexplained variance, whatever we cannot explain based upon our model, so this is the ratio between the explained variance out of the total variance. Out of the total variance what amount of that variance can be attributed to a particular- for that random intercept?

[Comment]

No, in this case the higher level thing is within the similarity of classes within the school ****. Whatever is the total variation here that we got for the same school is this is the variation that is at the class level. This is the variation at the school level, so out of those school level variants, different school level variants this is the total variance. Out of that how much is being explained by the school? How much of the total variance is being explained? Here whenever you are talking about the same school similarity of students within the same school **** this is your total variability. Out of this total variability what amount of that variance is being explained by putting a random intercept for the school?

[Comment]

This is in this case the question was why is this thing not .06 over here? Why is it .025? So in this case whatever we are looking at is we want to find out for this school within these classes. Here also if you go back to this one if you look at this what variance is explained by this school so that it takes into account the students? What variance is being explained by this school so that it takes into account the classes? So out of those classes how similar are those classes means this is the total variance. By taking into account the affect of the school we are accounting for this much variance ****. This much variance that we see between the classes is being accounted for by using this random intercept model.

[Comment]

Yes.

[Comment]

Within variance, yes.

[Comment]

Across schools, yeah. How much is the difference between the schools? For that we can account for whatever is the variability. We want to account- By putting all of these things we want to account for the variability. We want to reduce the variability and this is basically that is what we are trying to do over here. So it's saying that by having this number over here of .0153 **** this is the unexplained variance. This is the explained variance that is given by having the class level intercept and this is the school level intercept. By having these things what amount of that total variability is being explained by having the school, so there is a variability among students? Now out of that how much can be explained by the thing that they belong to the same school means only this much amount of variability, so the students are not very similar. If the students were very similar to each other means by putting the affect of the school we could have explained that whatever was the variability that we could find.

Here the thing increases a little bit because compared to the students the classrooms are much more similar within the school, so that accounts for more variability in the data that we see and here whenever we are looking at the school. This is the total variance. Out of that total variance whatever we are seeing, whatever we are putting here for the school this accounts for this much amount of variability. The data basically says that this is the kind of similarity that you are finding between the classes.

Okay, let me do this. When Dr. Hedecker comes, it seems like whatever I'm trying to say it's not sinking in, so I will talk with him and then maybe whenever he talks about the nonlinear models he will try to- he will explain some of these things in more detail and I think it will be you will find it much easier when he explains than when I'm doing it or if not I'll go over it again.

So all of these things are for the different level models, so null model is the model without any variable and this is for the model with all the variables in it, so these are the amount of variability that is explained by our model. Now this likelihood ratio test we already talked about how to do

the likelihood ratio test. This is basically the theory for the likelihood ratio test and the key thing that you have to realize is these degrees of freedom. How many degrees of freedom? How do you determine how many degrees of freedom means? In this model how many more parameters compared to the other model? So if I have a model with 10 parameters and I'm comparing it to a model with 7 parameters what is the degree of freedom that I need? It's the three degrees of freedom because that is the difference in the number of parameters between those two models and that is why we'll be using the likelihood ratio test and likelihood ratio test the theory says that when we look at the distribution for these things that follows a normal **** square distribution with this many degrees of freedom, so the easiest way for you to do, anybody who are doing likelihood ratio tests rather than figuring out what is the number of parameters in this model versus this model the easiest way that I think is to just look at the SAS output, count how many parameters are there in this model, count how many parameters are there in the model. In that case you can just subtract those things because next we'll be talking about this thing called the random trend model, so whenever you have a random trend model you add one parameter, the degree of freedom changes by two. You add two parameters the degree of freedom changes by five, so because of the core variance and I am going to show that, so it becomes difficult if you are not a statistician to be looking at this and say this is the difference in the number of parameters. So at the beginning level that is what I did when I was a student also. I counted- ran SAS, counted how many parameters here, counted how many parameters over here and the difference that gave me the **** square value for my degrees of freedom and in this case this is a **** square distribution, so when you subtract these two likelihood values it going to be a positive number and then you should just be using it and then this deviance thing.

In some of the software you may have already looked at it that the deviance is something that like **** and **** models, those kind of thing that the software produces by default to do the **** test. Is your model fitting well or not? So in that case if the deviance is more means deviance is basically the difference between them. So if there is a huge difference in likelihood means it is going to be what? Statistically significant. If something is statistically significant means the model is not fitting properly. If the deviance is a very low value means there is no different between the smaller model and the larger model, so you don't have to use the larger model. You can just use the smaller model and then do your analysis using the simpler model and this deviance is basically what you are calculating over here to see which model fits this and I think usually in **** if you **** in SAS some of those instead of giving you this **** likelihood value some of the times SAS will directly produce the deviance. It will do the subtraction between the null model and the model, previous model, some of those things and it will give you this thing and you can just look at the deviance value and say whether those additional parameters are they significant or not.

Now in this case if you look at the deviance for all of these difference models, the difference between the student-level model, student and classes, so you have 17.94. We already calculated the 17.94 at one degree of freedom and then we said that is it significant. Now here there is a column that says ****. What basically this **** means is like somebody did a similar analysis; somebody did this while looking at the likelihood ratio test, found out that the likelihood ratio test was a very conservative test. It did not allow you to reset the null hypothesis as often as it should because whenever we are doing our test at let's say **** 5% of the time that means if I do the analysis 100 times 5 times it should reject it. That is the definition of alpha.

Somebody did an analysis and found out that it was not doing it times. It was more like it was more like it was only resetting it maybe two times, three times, something like it was very conservative, so what this **** was if you are doing this variance component testing you are testing the random intercept variance versus the ordinary **** model, so in that case whenever there is a variance component whatever P value that you find just divide the P value by two. So if your P value came out to be .08 you would say that it's not significant, but the fact that the likelihood ratio test is a very conservative test you would divide this P value by two. Once you divide this P value by two you'd get .04 and in this case the proper thing to be using is .04, not .08.

So this is basically based upon a simulation study. When I was a student and I was doing this for my thesis I **** to my advisor we are not going to be doing that, but in this class when I was doing my work I did it always like that. I divided the P value and if you go and talk with some other statisticians they are going to say that this is just a simulation study. Somebody found out we are not going to be using it, but based upon the simulation study that is what was noticed and they published these results by Snider's [ph] and **** and they said that whatever is the P value, if you are testing, if you are testing the ordinary **** model with a model with a random intercept in that case if the P value, whatever P value you calculate divide that P value by two, so that is only for the random affect, not for the fixed affect, not while you are- We are not going to be doing the same thing for this one. We should not be dividing the P value for this analysis. We should not be dividing the P value for this one. For the fixed affect we are not dividing the P value, but whenever we are doing the testing for this random intercept and residual and in this case we do a likelihood ratio test and whatever is the P value that we find for the likelihood ratio test just divide the P value by two, so that the things will take care of the fact that this likelihood ratio test is a very conservative test.

Now for some of the software that is used in mixed model, the SAS you can **** mixed. That is the most popular and if you just do this test whenever I am doing some SAS coding if I run into trouble I just do a Google search. I just put **** mixed SAS and there is always you can find something that somebody else returned and you can use those SAS codes, if you want help about the particular function in this thing like I put this **** over here. Now suppose you want to find out what are some of these other options that you can use in SAS. The best thing would be like in Google just do a version 9 SAS help and then it will take you to the SAS help files and they have like a lot of examples, a lot of these codings. Everything is explained over there, so you can use that thing for the SAS analysis. There is a big online community that does the SAS work and they have published a paper called the SAS User Group Paper, **** papers and you can find some of these different methods compared over there and the easiest way rather than trying to look for it at a particular place if you just do a Google search and find some SAS code. You should be able to run some of these analyses.

[Comment]

Some of those **** papers they do. Some of the **** papers where people have done it they have done the simulation studies and they will say that we took this data and SAS has also done it like a lot of this help. In the help it has a lot of examples and in the examples it is running like

a lot of different things with the options and you should be able to do it, but the only problem that SAS has is by default it does not do the likelihood ratio test. It will give you the minus two likelihood value. You run one model. You have one of the minus two **** likelihood value for the **** model and then you have to manually compare those two things. By default it just does the **** test.

[Comment]

Complex software data from as far as I know with this **** mixed or the question was will SAS **** do it for complex ****. As far as I know this is not designed to analyze those kind of data where there is a different probability of sampling, but in some cases whenever those assumptions about the sampling techniques can be relaxed you may be able to use these options.

[Comment]

Complex- Okay, that may be another option, but I have not used that software, so I don't know how it is going to do it. It may be possible to do it, but even in SAS compared to the last version, this version, 9.2 they have added some of this functionality for **** and some of these things, so it may come in the future release of SAS where they are going to be giving more for this mixed model.

[Comment]

In that case from what you just described to **** we are just basically we have to relax some of the assumptions that we are making that usually whenever we are taking a sample our goal is like to pick up a random sample. **** that. Everybody has equal probability of being selected. In some of these complex surveys what happens is like- In some of these complex surveys that what people usually do is like there is a different probability of being selected because to select more people from a minority group somebody- there will be more selection and those things, so to take into account that you have to do the appropriate weighting in the survey logistic methods , right, survey ****, whatever it is, so if you can access those kind of things for this one you may be able to use it in a mixed affect model, but just like the way there is **** availability in SAS that just deals with logistic **** and for survey data, for mixed affect model I don't think there is anything right now.

Now Dr. Hedeker is here. Now he will be explaining some of these things that I don't know that has come out. He may be able to answer some of these thing better, but from as far as I know SAS has not come out with anything that will allow you to do this complex surveys **** like the way it is done for **** survey logistic, those kind of things that I have not seen anything in SAS.

[Comment]

Weight statement I think it does. Some weighting, yeah, I think it may allow some weight statement. All of those things we have to look into the SAS help file on how it treats the weight statement. In the SAS help file it will explain it how to weight all of those samples if it going to be a weighted analysis kind of thing.

Now for SPSS I have not used SPSS to do this analysis for mixed different model, but SPSS again, every time I want to use SPSS I just put a- do a Google search to see what kind of code it is or because the only time I use SPSS is whenever I have trouble coding in SAS because it's point and click. You should be able to handle the point and click with that thing to be able to do it in SPSS also.

Now we already went through this analysis for all of these things and there is some SPSS code that was used by Dr. Hadaka and his colleagues while doing the paper that was published in the *Journal of Clinical Psychology* and some of this is already over here. Now let's look at this statement, some of these things. Again, we already talked about this **** method because we don't want to use **** method for doing the analysis because **** analysis it collects for the bias, so if we are doing a testing for fixed affects we want to use **** method. If we are only interested in the variance component in that case, we may be able the **** method or the **** method and usually if you have a very big sample size the parameter estimates you are going to be getting for the **** estimates and the **** estimates even for variance components.

They are going to be very similar to each other. It's a very minute difference, but for the fixed affect and which I assume will be most of the work that you'll be handling. In those cases the best option may be to use the **** method rather than to the **** method and same thing for this core variance test. **** test by default SAS produces it's for doing the **** test for the variance components and in this case we want to use this thing as a guiding thing just to look at the output and see whether something is going to be significant or not, but if we are really interested in testing the significance we have to do the likelihood ratio test and while doing the likelihood ratio test what we do is since we are testing the variance component we'll divide the P value by two because the likelihood ratio test is a little bit more conservative, so to get a result that is more, so that we are resetting it five times. When we say resetting it five times we want to use the likelihood ratio test for that.

[Comment]

The question is what is meant by this halving this P value, so basically you do your calculation. You found out **** square is 7.8 and in that case you calculate the P value. You calculate a P value. The P value came out to be .0830 let's say, so in that case you are going to divide that .0830 and when you do that the P value is going to be .0415, so you are going to- since that .0415 is less than that .05 that you started with, that was our nominal level, we say that it is significant and that is why we do the likelihood ratio test and that is only when you are testing the variance component. Ordinary **** model and we have a model with random intercepts. When you are testing this model not for the fixed affect, just for the random affect, when you are testing those things then we'll be using that, that method to do the analysis.

[Comment]

Not just for the- We want to see what is the- Is it significant or not, right, for each of the clusters and not just for this cluster. Later on when we talk about this longitudinal data analysis we'll talk about different structure that we can put for the error variance. See in this case right here,

right now we have this assumption where we say**** square **** for the error and in some cases whenever you are doing this testing it does not have to be this structure only. You may put other different structure, which is like the auto aggressive structure, some of those structures for variance component, so whenever you are doing those testing for those things, whenever you are doing the testing for these different parameters in this structure over here in that case you'll be dividing your P value by two.

Okay, now we'll move on from the cluster design to the longitudinal design, so it's again for continuous data.

[Comment]

No, the best model for this study in the sense that from our analysis it seems like we don't have to do the three-level analysis because the school level variance is not significant and the parameter estimates that we get from the student in class and student school and the standard errors are very similar to each other, so definitely compared to the ordinary **** model we have to do a multilevel model, but in a multilevel model we can start with the three-level model, but we saw in a three-level model this is not very- this is not significant, so in that case I may be going with the model that are student and classes or student and schools, one of these things because I don't need the three-level model. Even if there is a three-level hierarchy structure I may be just able to do the analysis with just a two-level model in this case.

[Comment]

Yeah, in this case we tested the random- The question was, did we test that-? Did we do the testing for the random intercept? So in this-

[Comment]

No, this is only the intercept, so this is a cluster design, so we are not doing anything for the random slope right now. When we go to the longitudinal study and when you are looking at growth **** over time, that that are changing over time in that case we'll do a test for the random slope also to see how the groups are changing over time and in that case it will determine whether it is going to be significant or not.

[Comment]

Yes, in this analysis there is no random affect for the pretest, for the slope. It's just a random intersect that we are using, but later on when we- for the longitudinal especially. **** the longitudinal analysis the random slope is usually whenever you are looking at people growing at different rates over time, groups changing at different rates over time, so the initial assumption is the intercepts are the same and then we'll say that. Why just say that the intercepts are different? Let's make the slopes also different, so in that case we'll be doing it, but here, no, we have not done it.

[Comment]

No, in this case we have not looked at the random affect and-

[Comment]

Because of the study questions, if it was different Dr. Hedeker would have added, so I am assuming that it's we don't have to worry about that. In this case we just looked at the random intercept for the random slope. Nothing has been done over here. So the next one that we are going to be doing today is we'll be looking at the continuous case now, L1, LS SAS. So let's take like a few minutes break so that everything can be setup and then we'll go to the longitudinal case.