Webinar Transcript

Cost-Analysis Methods: What Are These Methods? And How Can School Districts Benefit from Using Them?

DALE DECESARE:

Thank you, everybody, for joining us today. My name is Dale DeCesare. And my colleague, Mark Fermanich-- are happy to talk to you today. And the topic of our webinar is Cost-Effectiveness, Cost-Feasibility, and Cost-Benefit Methods in Education Research.

And we've got a lot to talk about today, but we're hoping to make this as interactive as possible. So we have some quizzes and polling type things that we're going to do along the way. So Joe, I'm trying to advance the slide here.

JOSEPH BOVEN:

You should just be able to use your arrow keys to go ahead and do that if you can't tell me. It looks like you are controlling the screen.

DALE DECESARE:

It appears to be a little bit of a delay, but we'll go with it. So a little bit about who we are. We are part of the Regional Educational Lab for the central region of the country. And as you may know, the labs are overseen by the US Department of Education and IES, the Institute for Education Sciences. And our region covers the seven states including, Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, and Wyoming.

And our function is to work with education leaders in this region, to identify education issues of the highest importance to state and district leaders, and to conduct rigorous research studies, and provide technical assistance to help provide answers to things like, what types of interventions are working to help them use data more effectively? And in our conversation today, to talk about how we can not only provide answers to whether certain interventions are working, but what are the costs associated with those interventions? And what are some of the costs and benefits that people want to consider when choosing among multiple approaches?

Now, Mark and I work for a company called APA Consulting. We're located in Colorado. We've been around since 1983. And we work within REL Central to conduct research and evaluation studies.

So, Joe, maybe you could advance the next slide because it doesn't seem to be-- so the agenda for today-- we have three major areas that we're going to talk about. The first is just a

background of cost analysis in education research, in general. And why this is an important topic to think about.

The second is we're going to review three key cost analysis methods. And just so you all know, we actually are going to have some little hypotheticals that we're going to ask you to actually give your best answer to based on what we've talked about, so little bit of a quiz. And then to bring this into the real world, we have a study that we just completed for REL Central that was released earlier this year, that was an impact study looking at a teacher mentoring program in Colorado, but also included a rigorous cost analysis and an analysis of the value of some of the benefits that were generated by the program.

Next slide if you could. But first we wanted to hear from all of you. If you could use the Q&A function that Joe talked about at the very beginning— just let us know what your role is in your organization and what is your primary interest in learning more about the cost analysis methods? So we'll give you a second to fill that out.

And great, we have a mix of folks. So we have some district folks on. We have a teacher specialist is interested in the advantages and disadvantages of various cost analysis methods. We have a doctoral research student.

We have an evaluator who's interested in ROI, return on investment studies, in general. Education Research Institute looking at cost analysis methods and return on investment for high school programs. So we have a mix of some researchers and some folks out in the field who are interested in their district potentially using these kind of analysis in their own research, on their own interventions. So that's great.

All right, let's go to the next slide. So just as an overview of why we're having this conversation today, as most people know, educators, and educational leaders, right now, and policymakers are really operating in restricted fiscal environments where decisions about how to fund certain programs are at a premium. And there's no room to waste.

Education leaders are having to choose between a variety of interventions, many of whom claim to have benefits and impacts on students and teachers, and have different levels of costs associated with them. And they're having to choose among those. And what's the best way of using rigorous research to help make decisions about the best approaches to use?

Unfortunately, in traditional education research, even where we have rigorous studies that use comparison groups and experimental designs, many of the studies don't include details on the program costs that they're analyzing. And that's just something that has not been emphasized in research over time. Nor have researchers really tried to value the benefits associated with a lot of the interventions. And that's an important piece to understand when you think about the restrictive fiscal environments that people operate in.

It's also important to understand if you have identified a successful intervention looking at the impacts, and then other districts across the country or states want to try and replicate those programs, because in order to replicate them, you really need to understand how the

implementation of the project went. And what the resources were associated with that implementation. And looking at all the costs and resources that went into it are important part of understanding the implementation.

So IES, which oversees the research labs, has recognized this and in the past several years has really made an effort to emphasize and build more cost analyzes into rigorous research. One of the ways they're doing that is supporting a center at Columbia University known as the Center for Benefit Cost Studies in Education. And they have provided training to researchers. Mark and I both participated in that to implement a rigorous approach to costing out interventions and costing out the benefits of interventions. So some of the materials we have in this presentation actually come from some of the work of the Center for Benefit Cost Studies in Education.

So, with that, I'm going to turn it over to my colleague, Mark, to talk a little bit about the cost analysis approaches-- the three approaches that we're going to be focused on today.

MARK FERMANICH:

So as Dale mentioned, we're going to be looking at three of four well-known cost analysis approaches. The three that we'll be discussing are cost-effectiveness, cost-feasibility, and cost-benefit. The fourth approach, known as cost-utility, won't be addressed in this webinar.

And essentially, cost-utility uses various methods for trying to quantify, in particular, benefits that may be difficult, in the normal course of things, to quantify or put a monetary value on. It's also used to assess the values that people may place on an alternative, when that may not be obvious or when there may not be any direct quantitative way to measure that. So we will not be discussing that.

You should also note that often these terms are used— particularly, cost-effectiveness and cost-benefit are used interchangeably, but really they're very different studies that are used for different purposes. And so it's important as you get into this work, to understand the differences between the three or four different approaches and the terminology used behind them. Each of these approaches is considered a valid approach, but are designed to accomplish very different things, which we shall see as we go through some of the examples that we have later on in the webinar. We could go to the next slide.

So let's start with cost-effectiveness analysis. Under this approach, we would use this to compare several different program alternatives. For example, your district may be looking at maybe five different alternative reading programs to purchase and implement and you want to know which one is most effective, both in terms of producing improved student outcomes and costs, say, a READ 180 or Reading Recovery or Success for All. So you could use cost-effectiveness to determine which of these alternatives are the most cost-effective.

When you're doing cost-effectiveness analysis, you need to have a common outcome measure. So in our example of selecting a reading intervention, you would need either a common assessment that's been applied to the outcomes of the three, or four, or five different

interventions, or at least you need to be able to equate them so that you have comparable measures. For example, you might use the reading portion of a state assessment or a district developed or teacher developed assessment.

When you're doing this type of analysis, what you'll do is you'll combine both the outcome measures, so say, the test scores or the improvement in graduation rates, with a detailed and robust cost analysis, so that you know exactly what the costs are for implementing and operating this program. Ultimately, what you hope to get out of the analysis is a ratio that is the cost per unit of improvement achieved. For example, you may have a program where for every $10 per student that you spend on the program, assessments have shown that students on average will make a one-point gain in the scale score of whatever assessment you're using.

We should also note that the most effective approach, or program, or alternative that you're looking at may not always be the most cost-effective. So you may be able to get, perhaps, more improvement using one program, but because it's significantly more expensive, the cost per unit of improvement may be significantly more than another alternative. So what we're really doing is trying to look at which one is both effective cost wise, as well as in producing improved student outcomes.

So this is our first little interactive session. Just to provide an example, so here we have three different programs that we're looking at in our hypothetical school district. They're all aimed at trying to improve reading scores.

So Program A cost $1,000 per pupil and will yield a 50-point gain on your MAP reading scores. Program B costs $2,000 per participant and will yield on average of 75-point gain on your MAP reading scores. And then we have Program C, which costs approximately $500, so significantly less than the other two options, and yields, again, a smaller point gain of only 30 points on the MAP reading score.

So in looking at this, based on what we've talked about so far, which of these programs would you think would be the most cost-effective and thus the program that you would recommend to either your superintendent or your school board to purchase? And we'll go to the polling feature. And you'll get a chance to indicate which of the programs you would select. We'll take a couple of minutes, or about a minute or so, to let you make your selection. And then we'll talk about how we did.

Question about who we're working with on this. And I think what the question is is— so we had mentioned that we've received training. And many of the materials that we're using here have been developed by the Center for Benefit Cost Studies in Education. And this is that teachers college at Columbia University. It's under the direction of Dr. Henry Levin. So hopefully we answered that question.

So it looks like most of the people that answered the question chose Program C. And I'm just wondering if anyone would be willing to use the Q&A button to give us a brief rationale for why

you chose Program C. What is it about Program C that would make you think it's the most cost-effective program among those three choices?

And again, if you could use the Q&A button, we'll give you a little bit of time to think about that if you're willing to volunteer to put your rationale out there. One response saying that it has the lowest cost per student point gained. So someone did the math. We're happy to see that. So let's go on to the next slide and we'll discuss exactly that.

Yeah, if we could advance to the next one.

It doesn't seem like we're able to do that for some reason. It's indicating that we're in control of the screen, but we don't seem to be. Okay, so which is the most cost-effective? So, if we look at Program A, at $1,000 for 50 points of gain, that comes to $20 per point gain. Program B, with the whopping 75-point gain, cost $27 per point gain. And then Program C, at a cost of $500, yields 30-point gain or $17 per point.

So the correct answer was Program C. That is the most cost-effective because it's the least expensive for every point gained on your reading scores. If money were no object and you were looking at the program that would just give you the greatest gains, then perhaps you'd want to recommend Program B because it will yield a 75 point gain, which is more than twice Program C, but it's also at a significantly higher cost. So that gives you a little bit of an idea of how, in looking at these alternatives for cost analyzes, that it really depends a little bit on what your endgame is as to which method you're going to choose.

We can go to the next slide.

All right, so cost-effectiveness analysis, as with most things, has some strength and also some weaknesses. So among the strengths are that it can be fairly easily integrated into a standard program evaluation. And of course, we would urge those of you who are working in program evaluation to do that, and with the caveat that you need to make sure that part of your program evaluation, your evaluation design, would include the detailed cost study that you need.

One thing that we've learned and others have learned over time is that it's very difficult to go back after the fact and try to accurately capture all of the details on costs and the amount of time people put in on the various activities. So it's much better to try to collect that data as the program is operating, rather than after the fact. Also, it's very useful for comparing alternatives that either have a single or a small number of the same objectives. So in the last example, we were comparing programs that had the single objective of trying to improve reading scores.

Among the weaknesses is that you do need that common outcome measure. So you wouldn't be able to compare the cost-effectiveness of a math remediation program and a reading remediation program, because they're really two different types of outcomes and two different types of measures.

It can be difficult to interpret results if there are multiple measures. So for instance, say, in the last example, we weren't just looking at, say, an overall reading score, but we were looking at how each of the programs may have impacted the speed at which students read, their comprehension of what they're reading, and their vocabulary development.

So we'd presumably, for each one of those three options, we'd need to do three separate cost-effectiveness analyzes, which would give us a cost-effectiveness ratio for three different things, the cost to speed, cost to comprehension, and cost to vocabulary. But it be much harder to determine what that means in trying to assess those three alternatives than just looking at the single overall reading score.

Other weaknesses include, it's not able to judge the overall worth of a single alternative. So it may tell you which is the most cost-effective among those alternatives, but it won't tell you whether it's worth engaging in that strategy or that program to begin with. OK, if we can go to the next slide.

The next cost analysis approach we're going to look at is called cost-feasibility. And this is probably the most straightforward and simple approach. And really what it's used for is to basically use cost as your primary, if not only, criteria for making a decision.

So if you have a very hard budget limit, say, $300,000 that you can't go over for purchasing some sort of intervention or program, then you could use cost-feasibility to fairly straightforwardly eliminate any of those alternatives that you're considering that may cost more. So for instance, if you're looking at four programs and two of those cost more than $300,000, one is $400,000, the other $600,000, then those two would be jettisoned based on your $300,000 cost limit criteria. The strengths are is that it fairly simply allows you to rule out alternatives that are too expensive.

But on the other hand, the weakness is that it really doesn't give you any assessment of how effective those programs are, either in overall effectiveness or in cost-effectiveness. One way that you may be able to use this is, say, you've got a large number of alternatives that you are looking at. Say you've got eight, or nine, or 10 alternatives. You may set a budget limit which will eliminate four, or five, six of those. And then you could follow up with a cost-effectiveness analysis on the remaining four or five alternatives, to find out which would be the most effective among those remaining alternatives. Go on to the next one.

And then finally, the last of the three approaches we're going to discuss today is cost-benefit analysis. And that's essentially used to identify both the costs and then a full range of benefits, which the program or maybe multiple programs, related programs, would produce. So for instance, you may be looking at a program that improves graduation rates. Well, that program may do a number of different things. It may not only improve graduation rates of students, but it may have other benefits, such as improving the retention of teachers, or improving the learning environment of the school, and then also may have some longer term benefits, such as improved life outcomes for the students participating in the program.

An advantage of the cost-benefit analysis is that it doesn't require common measure. The benefits are identified for this specific program or intervention that you're dealing with. And of course, you need to conduct-- in addition to determining what the outcomes or the outcome improvements are, you also need to conduct a comprehensive analysis of the costs. So you need to get a lot of details on exactly what it costs and what the resources are needed both in terms of money, and persons, and materials to implement and operate the program.

Like the cost-effectiveness analysis, the outcome for the end point of the cost-benefit analysis is also a ratio known as the cost-benefit ratio, which is essentially the per participant or per student total benefits of the program, divided by the per participant or per student cost of the program. Thus, if you have a ratio that's greater than one, that means that your benefits are greater than the costs and so the program may very well be worthwhile doing. We can go onto the next slide.

So strengths of the cost-benefit analysis— so again, no common outcome measure is needed. The focus is solely on the costs and the values of the benefits of that particular program, rather than comparing across. However, it can be used to compare multiple projects if you would do multiple cost-benefit analyzes.

So you could do cost-benefit analyzes on, say, whether to implement a teacher retention program, or to improve graduation rates, or to improve math scores, and compare the cost-benefit ratio for each one of those to determine which one might be the most bang for you for the buck of the district. Cost-benefit analysis can also be used to judge the worth of that single project. So basically, it's telling us— unlike cost-effectiveness, which is telling us which is the most cost-effective among a number of alternatives, the cost-benefit analysis tells us through that cost-benefit ratio whether it's worth doing the project at all.

And then it also takes into consideration opportunity costs. And in this context, what we mean by opportunity costs would be the implications of not adopting the project, or the program, or taking whatever action you're considering. So for example, if you're looking at a program that might improve graduation rates, conversely, what the cost-benefit analysis could tell you is, well, what are the costs of not doing this, which, obviously, would be less robust life outcomes for the students that end up dropping out because there is not the graduation program in place to support them to graduate from high school.

And then finally, it can help to identify and to value both long and short range benefits. So some benefits may accrue over the lifetime of the participant. Others may accrue immediately or within a short period of time, maybe one to three years for the school district, itself.

All right, a couple of weaknesses— in particular, it can be difficult to place a dollar value or to monetize the relevant benefits. So if we know that doing, say, better in math leads to not only a higher odds of graduating from high school, but also higher odds of attending college. And we know that, but we also know that, in general, people who attend college and graduate from high school have lifetime earnings that are higher than those who drop out of high school. But that can be very difficult to determine because in most cases, that's going to probably take a

long-term longitudinal study to look at, say, a treatment group of students who went through the program, versus those who did not go through the program.

And look at what the difference was, not only in graduation and college going rates, but then also what happened to them over the course of the next five, 10, 15, 20 years, or maybe even the entire working life, so that we can determine whether they did, in fact, have higher earnings. Do they pay more in taxes as a benefit to state and local governments and the federal government? Did they have just better life outcomes in general?

Also, because of the on being on identifying benefits that can be quantified and monetized, this approach tends to advantage those programs that will result in easily quantifiable benefits. So if you've got three or four different programs you're looking at, one seems like it would be fairly straight forward for doing a cost-benefit analysis, the other ones you're maybe scratching your heads on exactly how you're going to value and monetize those benefits. Well, the default action may be to look at the program that's more easily quantifiable. Go on to the next one.

DALE DECESARE:

We could take a pause here, before we do this hypothetical, and just see if anyone has any questions? That was sort of the overview of the three approaches that we're talking about. And we're going to go through a few hypothetical examples, but if anybody has any questions about what we've talked about so far, you can take a second and type those in. And we'll see if we can answer those.

We do have one question. We're not quite sure which slide this applies, but it asks, what was the objective and who funded? We're not sure if that's a question related to the overall Cost Benefit Analysis Center or whether it's one of the programs that we were using as an example? So it looks like we may not have any questions. So now I will turn it over to Dale for the next several slides.

So we're going to use the polling feature again. And we're going to give you a hypothetical situation and ask you to pick which of the three methods that Mark just went through, cost-effectiveness, cost-benefit, or cost-feasibility, that you would apply to answer the question. And then we can talk a little bit about why folks made the choices they did.

So the first one, the State of Improvement, which we've determined is an actual place, is interested in increasing a high school graduation rates statewide. State Department of Education officials are interested in several different programs. The cost of implementing each program is around $5 million dollars.

And what the department wants to determine if implementing one of the programs will be worth that program's costs. So let's take a minute and think about that. And we'll put the poll up. And make your choices.

So hopefully, you can see the results. What we have are— the folks that responded, the largest number, 45%, chose cost-benefit, 36% chose cost-effectiveness, and 18% cost-feasibility, which is interesting. And let's talk about some of these answers.

The cost-benefit analysis, I think, is a valid choice to make in this because what we specified was the department wants to determine if implementing one of the programs would be worth its costs. So probably the best way to answer that question, if you were looking at one of the alternatives and wanted to know that one that the benefits outweigh the costs, you would use a cost-benefit analysis. And the question here is what your outcome measure would be. You'd use high school graduation. And you'd want to be thinking about things like career earnings tied to high school graduation, and whether those career earnings over time outweighed the cost of the program, things like that would be part of the cost-benefit analysis.

Now on the other hand, the cost-effectiveness, I think, is another interesting question and a way to address this question. Because if you did have a common outcome measure, and high school graduation is a common outcome measure, and you know the cost of each of these programs, you could try and look across the programs to see which one— if they all have the same cost of $5 million, which one produced the most graduates. If you had rigorous data from a research study that could show that, you might be able to look at the cost-effectiveness across interventions.

The key there, again, is that you want to have a rigorous approach where you have a comparison group for each program, where you could actually screen out differences if it was implemented in different districts with different characteristics. So then you could be sure the difference in graduation rates was attributable to the program and not the specific characteristics of the district that was implementing it.

On cost-feasibility side, if the goal was to make sure that all the programs were under a certain cost, you could look at that look at it that way. In this case, we specified the cost of each program was $5 million. We didn't specify whether that was over or below budget. But that's just walking through the different options here. And we'll go on to the next hypothetical and see how folks respond.

MARK FERMANICH:

All right, for our next scenario, the Nowhere County School Board is going to adopt the new reading intervention program for early elementary grades, one through five. The district has $300,000 to spend on an intervention. And the district's curriculum office is looking at seven different interventions. However, price is the most important criteria to making a decision about which alternative intervention that the district will select.

So again, we'll use the polling feature. Give you some time to think about which of the three approaches might be best for making a recommendation to the Nowhere County School Board.

All right, so at this point we have preliminary results. And it looks like 21% of respondents thought it was a cost-effectiveness analysis, 75% of respondents thought it should be a cost-feasibility analysis, and 4% thought a cost-benefit analysis. Is there anyone out there who would be willing to share the reason behind selecting the approach that you did? If anyone's interested in sharing their reasoning, please use the Question and Answer button and type a short rational.

Well, it looks like the vast majority of people responded with the answer that I think we would agree with. And that is that this probably would best be— the recommendation would best be made via cost-feasibility analysis because, really, for the Nowhere County School Board, the $300,000 maximum budget for the intervention was really the key criteria. And even though that district's curriculum office may have been reviewing a number of interventions, it doesn't really— at least in this scenario, we don't really specify that they were looking at whether which ones were most effective in terms of improving reading in grades one through five in the district.

So again, if you had the seven interventions and maybe three of them ended up costing more than $300,000, then after you've done the cost analysis, then you would drop them from consideration and look at the remaining four. Now, certainly, once you have those four are identified as falling within your budget limit, you could do a cost-effectiveness analysis to see which among those four alternatives might be the most cost-effective in getting gains for the least cost per gain on a reading assessment.

So let's move on to the next scenario. If we could go to the next slide, Joe?

DALE DECESARE:

All right, so more creative names here. The Balderdash City Schools is adopting a new math textbook and curriculum for its elementary schools. The district will select from one of four different vendors that pass an initial screening. The district has the estimated cost of purchasing and implementing each of the four options and has data from both the vendors and external evaluations on each program's impact on student achievement. Which approach would you use? And we'll put the poll up again.

And again, if anyone has comments or questions, either about this hypothetical or wants to explain why they made the choice they did, just use the Q&A box.

Great— so the majority of folks, 67%, chose cost-effectiveness, and 0% on cost-feasibility, and 33% of those who answered chose cost-benefit. And on this one, I think, since we're really talking about trying to compare across four options and because we have— at least we know that there's a common target, which is around mathematics.

Assuming that you could come up with a common outcome measure, which we would assume is probably some type of a math assessment, and that the evaluations that were done are rigorous and use a similar or common outcome measure, then really, cost-effectiveness, as

most people selected, is probably the way to go, because you could actually compare across the four vendors and get a calculation for an outcome unit increase per dollar spent. And that would really help the school district, then, select from among the four different vendors.

Now if the school district wanted to zero in on one of them, they could do a cost-benefit analysis with that information, but probably the most appropriate approach on this one is cost-effectiveness.

All right, we have one last hypothetical and then we'll move on.

MARK FERMANICH:

All right, in No Name Public Schools they are examining ways to improve student writing. And they're looking at three different potential solutions. The first one is to reduce class sizes with an emphasis on more writing. So smaller class sizes, more one-on-one time with the teacher, more emphasis on writing.

The second is to hire college students with strong writing skills to support instruction, presumably, as one-on-one or small group tutors to work with students on writing. And the final option or strategy is to develop new writing courses for students that they would take in addition to their regular English classes. So we have these three choices. Presumably, each one is going to have costs. And presumably, we could somehow measure what the outcomes are from each of these approaches.

So again, using the polling feature, why don't you give us your best guess on what the most appropriate approach is for conducting a cost analysis. And once again, if anyone is interested in sharing the rationale for your choice among the three approaches, please feel free to share that using the Q&A button or if you have a question regarding the scenario.

All right, so it looks like not quite half of you selected cost-effectiveness, about 11% cost-feasibility, and a little over 40% cost-benefit analysis. And this is kind of a tough one. It could go a couple of different ways.

But I think if you think through the steps. So, because the focus is on writing, presumably, we'll have a common outcome measure, which could be some sort of writing assessment. Obviously, all of these are going to have cost that could be studied and quantified. And obviously, we're comparing multiple alternatives.

So I think this would be most likely— the recommendation could be based on a cost-effectiveness analysis. Meaning, that we would look at, again, the common writing assessment. We would look at the costs and compare them. And then select the option that was most cost-effectiveness, so had the best cost-effectiveness ratio, or the least cost per point gained on whatever the writing assessment is.

So let's move on to the next topic where we're going to talk— oh, it looks like we have a question. In practice, how often does a school district have access to rigorous information

about the outcomes of a given set of programs under consideration? That's a good question. And it's certainly going to vary based on the particular intervention that you're looking at.

Many vendors will provide their own in-house studies of the impact of these, which I suppose you may want to take with a grain of salt. But also, particularly more well-known programs will often have external evaluators who will have looked at them and will have published the results in peer review journals and done fairly rigorous assessments of the impact of these programs. You also have other sources of information, such as the Department of Education's What Works Clearinghouse.

So again, it's really going to depend on how well-known or how prevalent the alternative has been around, the intervention has been around, and whether people have found it compelling enough to study. So it's going to depend on the types of interventions you're looking at.

DALE DECESARE:

OK, great.

Now that we've run through the three approaches, we wanted to talk about regardless of which approach you use, how to look at assessing cost of an intervention. And what we're recommending based on what researchers have done nationally is using a really consistent method that is known as the ingredients approach.

And what this approach requires is really-- the best way of doing this is in real time, while you're evaluating or analyzing a program, not looking back in time after the intervention has already run, but to collect detailed descriptions of the intervention include— and we'll talk about what the resource pieces are associated with that.

And based on the detailed description, they're even looking at a program's logic model. What are all the resources that might be needed to execute the intervention? And then how can you assign reliable cost to each resource?

Really, the best way to do this, like I said, is to observe the intervention directly if it's possible. And sometimes it's not possible to do this if there aren't enough resources for the research or evaluation study to actually have researchers observe or attend at least parts of the intervention. For the study that we'll talk about a little bit later, that we conducted through REL Central, we did have those resources. And that made it much more reliable that we could attend meetings and see what type of staff are involved, what was the time commitment of these people, and then start gathering information on salaries and things like that.

It's also important to think about conducting what are called sensitivity analyzes when you're looking at costs. If you're gathering cost information, for instance, through interviews with participants, there might be a range of costs associated or a range of time commitment associated with the particular intervention. And you want to run a sensitivity analysis where you assume the highest amount of time is spent on a particular activity, a lower amount of time on particular activity, and kind of understand what the range is. And depending on the high or

the low, does that actually tip the program to being not cost-effective or not cost-beneficial using sensitivity analysis? And a lot of studies don't conduct those sensitivity analysis as part of their work.

And go on to the next side. So when we talk about an ingredients approach, we're really talking about the actual components that are required to operate any kind of an education intervention. And so in the district setting, first and foremost, is always personnel. And that's where if you have limited resources to study cost, you want to put a lot of your effort into looking at what are the personnel costs because they tend to be 75% or more of the cost of most education interventions.

And what you need is enough specificity of the type of staff that are being called upon to interact or spend time in the intervention and what the qualifications of those staff members are, so that you can understand what the salary and benefits are associated with each type of staff member. And it's not just teachers. You want to think about administrators who are required to oversee the project, coaches, support staff, substitute teachers, things like that.

And often time, districts don't necessarily consider all these costs when they're thinking about an intervention. If they have to purchase something from a vendor, sometimes they might just think of what the purchase cost was for purchasing an intervention and don't necessarily cost out all the associated trainings, or meetings, or planning that personnel actually have to undertake to implement the intervention. And those costs really should be considered if you want to have a complete robust comparison. So personnel is obviously number one.

Facilities— and you'll see later when we talk about the real world study we did. If you really want to take into account all the costs, you want to understand what the facilities costs are over time. If there is a lot of meetings space used, or if there's even cleaning, and things like that that have to happen, that ordinarily have happened without the intervention.

Equipment and materials, which could include technology or printing costs. In-kind inputs could be volunteers or things like that, where if you wanted to actually take into account the time volunteers put in to participate in an intervention, that could mean an in-kind input. And opportunity cost that Mark talked about earlier— if there are other ways that people could have been spending their time, for instance, you might want to consider those as opportunity costs for implementing a particular intervention.

So really, the key things to talk about and the focus on here when conducting this kind of research is to, if possible, observe the intervention in real time. And be able to keep track of all the assumptions that are being made about staffing and other costs. And to document the cost information you're gathering. Next slide.

MARK FERMANICH:

Okay, and as we noted before, when we were talking about cost-benefit analysis, we said that you're not only interested in identifying and quantifying the costs at some level of detail, but

you also need to identify and value the benefits that may result from the intervention of the program, or the project, or whatever it is. These benefits may be long-term or short-term. So for example, if you implement a program for reducing teacher turnover, you may have some short-term benefits that you may see immediately or within a one-, or two-, or three-year period that reduces some of your human resources costs.

So if you have fewer teachers that are turning over, that are leaving the district in any given year, that's going to reduce the cost to the district of having to advertise and process applicants for the teacher position to get them into the system. Once they're hired, provide induction services so that the teacher knows what the curricula that are being used— all the various things that occur in inducting a new instructor, a new teacher, into a school district. So those would be examples of short-term benefits. And they're fairly straightforward and probably could be very easily measured and quantified, locally, at the district.

But then you may have some other teacher retention benefits, such as increased productivity. The teacher increased productivity, more often than not, means that the teacher's instructional ability has improved. They have higher quality instruction.

So that higher quality instruction may lead to better student outcomes. Kids do better on assessments, they're more likely to stay in school and graduate from high school. And depending on just how much better they did, they may be more inclined to attend college, either for a few credits or perhaps to go on to get an associate's degree, a master's degree, or so on.

And then those types of outcomes lead to other types of outcomes, for instance, that lead to better life outcomes for these kids. So because they did better in high school, graduated from high school, attended college, they're more than likely going to have higher lifetime earnings, which means they're going to pay more in taxes, which is good for state, local, and federal governments, and may have engaged in lower social spending. So they've had less need to, say, access welfare programs, subsidized health care, probably a lower chance of having been engaged in the criminal justice system because they were involved in a crime.

And also, we know that more highly educated people tend to have better health. So there may also be a benefit to just lower overall health spending in the system. So those are two of the differences between short-term and long-term benefits. The monetizing, or putting some sort of a dollar value on these benefits, can be complex and can take fairly sophisticated longitudinal studies. So go on to the next— all right.

So how do we go about valuing these benefits? Well, there are three common approaches to doing this. The first one may be by conducting an experimental, or quasi-experimental, or correlational study.

So by an experimental or quasi-experimental— experimental study, let's stay with that, generally means that you may have a group of students who are randomly assigned to a treatment group, so they're actually going to participate in whatever the program or

intervention is. And then you have a group of students that are randomly assigned to a control group. And they will not receive whatever the intervention or program is.

Quasi-experimental, basically, are using other types of statistical approaches to approximate an experimental study, if you're not able to actually do an experimental study on the ground. And a correlational study is just a more simple— a regression that looks at a correlational relationship between an intervention and outcome. So that's one way of doing it.

Another way of trying to value benefits is to think about or to ask individuals how much they're willing to pay for that benefit. So if their students engage in some sort of intervention, what is that worth to the parents if they were required to pay for that? A third way, the final way, of approaching this valuation of benefits is to look at, well, are there either instances where this impacts something in the marketplace or is there some similar comparable service that's available in the marketplace and that's priced?

So if you have a comparable similar service provider in the marketplace, well, then we can say, well, we guessed that the price that people are paying for that would be a good approximation for the service or intervention we're providing in the schools for free. But in reality, in most cases, we will probably rely on the research of other researchers who have more expertise in doing these types of studies, to help provide estimates of the value of these benefits. Please go on to the next side.

So let's look at a couple of more specific examples that go in the same order of what we just discussed. An example of an experimental study would be say a longitudinal study that looks at, again, participants in a vocational training program. So again, we have a certain number of participants that were randomly assigned to the vocational program. And then we're going to track the number of students or participants who did not participate in the vocational training program. And we're going to look at what happens to them over a long period of time.

We may want to check in every so many years to see what's happening. So you may want to look at what happened to the two groups after five years, after 10 years, after 15 years. We could go all the way through retirement.

And we want to then look at, okay, what is the difference between the two groups, those who were in the vocational training program and those who were not? What is the difference in their earnings? What about other life outcomes?

Did one group have statistically significant better health outcomes than the other group? Did one group pay more in taxes? Did one group or another have less involvement with the criminal justice program?

In terms of surveying individuals, an example of that could be— by surveying individuals, perhaps ask them questions on their willingness to pay for the benefits. So, that could include surveying low income parents of preschool children. And asking them well, if you had the funds available, what would it be worth to you— what would you be willing to pay so that your kids

could attend a high quality full day preschool program? That'd be another way of trying to estimate, well, this is the value of that benefit, at least to this particular population of parents.

And then finally, there have a number of studies that have looked at what impact the quality of schools in a neighborhood may have on home values in that neighborhood. And so you could look at, if you're trying to get an idea of what does the marketplace say about the value of this benefit— well, one way of, perhaps, valuing the value or monetizing the value of higher quality schools would be to look at the value of homes in a neighborhood served by higher quality schools, versus a neighborhood serve by less effective schools. So those give you a sense of how those three benefit valuing approaches might actually look in a real life study. Let's go on to the next one.

All right, so we're going to take— we know we've been throwing a lot of information at you over the last— about an hour now. So we're going to just do a quick summary of what we've covered so far. So overall, cost-effectiveness, or cost-benefit analysis, or any type of cost analysis really, is missing from the vast majority of educational evaluation studies. It's just something that most researchers, to this point, have not been interested in looking at.

However, we do know that in many cases, it's becoming more important. And certainly, IES has certainly thought that it's more important. That as we have higher expectations with less resources that it's important to look at both the impact side and the cost side of any intervention or program.

The three cost analyzes that, at least, we've made the determination that we think would be probably most useful to states and school districts are cost-effectiveness, cost-feasibility, and cost-benefit. And we use, obviously, cost-effectiveness to compare a ratio of unit of improvement in an outcome to the cost, requiring a common outcome measure, and, basically, then selecting among those options the one that has the least cost for each unit of improvement.

Cost-feasibility is that very straightforward analysis of looking at what are the total costs and do those total costs exceed what we have available in the budget to pay for a program or an intervention. And if it does, then we, obviously, can't select that option. We have to look at options that stay within our budget. Next slide.

And then finally, cost-benefit analysis-- that answers the big question of whether it's worth doing, whatever it is we're looking at doing at all. And that looks at doing a very comprehensive and detailed look at both the value of the costs, so the total quantifiable amount of the costs, as well as the measurable benefits that we've been able to identify and put dollar signs to. And then to the extent that the total benefits exceed the total costs, that it may make sense to actually move forward and do whatever that is we're looking at doing.

All of these methods require a detailed accounting of implementation and operations costs, which we call the ingredients approach, which was developed largely by Levin's shop at Teachers College. Cost-benefit analysis, as we discussed, also requires a fairly sophisticated and

complex valuing of the benefits that we've observed. And a lot of times this is a two stage process, whereby the benefits may be that the immediate benefits may be higher graduation rates or better scores on reading or math tests, but in the long run those better scores or higher graduation rates may lead to other benefits accruing to the individual or to society down the road, such as better health, better earnings, fewer government programs tapped. Go on for the next.

DALE DECESARE: So we've been talking about, up until this point, is the theoretical underpinnings of cost analysis in education studies. And what we want to move on now is to a real world example that was just completed of an actual study that was done in a district in Colorado. If anybody has any questions, up until this point, please, again, put them in the Q&A and we'll try and answer those.

But the study you see on the screen, now, was published earlier this year and focused on a program that was developed in a school district in Colorado, called Aurora Public Schools, which is one of the larger urban districts in the state. And what they were interested in was a new approach to mentoring teachers. That we'd use recently retired master educators, people who had worked in the district for quite a while.

And one of the motivations of the district for doing this was around cost. They were seeing a lot of teacher turnover, as we'll talk about, and were really looking for to find cost efficient ways of supporting new teachers, who they were trying to keep. And the thought was, maybe using retired educators, who you don't have to pull out of a classroom while paying a full salary with benefits, could be an effective way of supporting new teachers without the full cost of taking a current teacher out of the classroom.

So we'll talk a little bit about how we actually did this. So go to the next slide. So just a little bit about the study. This was what they call, making an impact study, for IES. And was a two-year randomized controlled trial study, which was conducted in the 2013-2014 and 2014-2015 school years. And we had 77 classroom teachers and 11 schools.

And within each school, half of the teachers, the new teachers, were randomly assigned to a control group or a treatment group. And the control group received the district's business as usual mentoring program. And these were teachers in their first three years at the district. And the treatment group was assigned to a retired mentor.

And all the schools that participated were Title I schools with approximately 90% free and reduced lunch, and had very high rates of teacher turnover, and had a persistent student performance challenges. So what the goal was, was really to compare the impacts on the new teachers that received support from retired educators with those teachers who were just receiving the business as usual support. And I'll talk a little bit about what those looked like. Go to the next slide.

This is a shot of the logic model behind the program. And I mentioned the logic model before. As just a way of helping, when you're thinking about doing a cost analysis, the logic model can help in several ways.

The first block there— thinking about the current situation, the need diagnosis. For Aurora Public Schools the needs are around supporting probationary teachers so they can be more effective, retaining teachers, dealing with teacher turnover, and really trying to do something to improve student performance. Those need pieces can also help you identify where are you want to focus your outcomes and which outcomes are the most important to measure.

And then, of course, the middle box, the major intervention components, that gives you an idea of where you should be looking at program costs, tracking costs. So in this case, they are paring probationary teachers in high needs schools with master retired educators over two years. There was a summer professional development component and this emphasis on individualized mentoring and support in the classroom. All those suggest cost components that we had to consider when we were evaluating the program. Let's go to the next slide.

So just so there's an understanding of the different resources involved, also, the business as usual program for the district was a typical, what you might see in many districts, something they called a buddy mentor program, which was really a one-year program. There was no selection process for the mentor. It was teachers willing to do it, who volunteered in the building. Really, no training or classroom release time provided for the mentor, in order to work with the mentee.

So there was no expectation that the mentors would be observing the mentees instruction. Really, it was a minimum expectation of about 15 hours of meeting, over the course of the year. And the mentor received a $500 stipend for that.

The treatment of the intervention, in contrast, used to be retired mentors. It was a two-year program. And they had rigorous selection criteria for the mentors. Mentors had to have evidence of success in the district, working in high needs schools. They had to go through an interview process, had to have at least five years teaching in the district, most had around 20.

And for those who were selected as retired mentors for the program, they had to participate in training. They had to be available to meet with teachers before, during, and after school. There was an expectation for at least an hour and a half a week of meeting with mentors and actual observation in the classroom.

And they could use a mix of taking their mentees to model classrooms to do observations. They could do co-teaching. And the mentors received a pay of, on average, $42.50 an hour. Next slide.

So as we looked at the program logic model, and you think about the key outcomes that the district was focused on, the randomized controlled trial that we designed, basically, had three key outcomes. The first was student achievement. And we focused on both reading and math.

The district is the NWEA math assessment in elementary school. And all these schools were at the elementary level.

And so the students who were students of the treatment group teachers and students who were with the control teachers, were assessed in fall and spring both years in reading and math to understand what the differences were in achievement. That was a major outcome measure. Teacher evaluation scores— we used the district's own rubric, which was administered by principals and school leaders each year. That was used to evaluate teacher performance across, I think, 11 different factors that the district had identified. And finally, teacher retention, which was a significant concern for the district. And this was measured from the district's HR, Human Resources Department, which gave us figures at the start of each new school year for which teachers had remained in the school district.

So the three, kind of, basic steps that we used, and this aligns with what we've talked about up until this point, to doing a cost benefit analysis of this program was to make sure we collected detailed data on program costs in real time. So our researchers were able to actually attend meetings of the mentor team to observe mentors working with mentees— to meet several times a year with the district grants office personnel. The grants office was overseeing the program to see, what did it actually take to administer the program, to keep track of all of the time sheets that mentors were submitting, to plan meetings and meeting space, things like that?

To collect impact data on teachers and students. And we just talked about the three measures we used on impact. And then using both of those pieces to determine the value of benefits to teachers or students. OK, next slide.

So real quick we could just-- if folks want to write in or just think on your own, what costs you think would be associated with this program? And what benefits on associated dollar savings might be expected? Feel free to write those into the Q&A or just to think about it on your own.

And I can talk through some of them. The more obvious costs, as we thought about this in collaborating with the district, was obviously things like mentor time and pay. And the district provided us all the time cards and things like that that mentors spent.

But we had to also consider some of the less obvious costs. Mentors meeting in a team several times each semester— where did they meet? What space was used? What materials were provided at the meetings?

Each of the mentored team meetings involved the district head of professional development, who was training the mentors to make sure that they stayed on top of any new developments in the district. So that required that person's time. And even though they are a salaried employee of the district, we wanted to track what amount time did they have to invest in training the mentors.

We talked about substitute teacher time for the mentees to go visit model classrooms with their mentors. And really, trying to think of all those costs as part of the cost of the programs,

so that we could say we did a very rigorous and thorough job of determining, not just what the district had set aside in its budget, because the district did have title money set aside to do this, but what all the staffing costs were associated with those, and materials, and space, and things like that.

So again, this just lists through some of the things that I just talked about. We looked at mentor pay and mentee stipends for meeting with mentors before and after school. And all the costs associated with program administration. And then what we did is we summed those up and came up with a per mentee cost.

And we knew the local cost to the district because we met regularly with the grants office. And we knew exactly what they were paying folks, what the salaries were. But we also wanted to consider if this study was published nationally, a district in a different state that wanted to implement this program, the prices might be different in Colorado than in other places. So we used a national database to convert local costs into national prices. And we'll talk about that in a minute, but that's important in terms of the replicability of the program in other places.

And so once we have a firm understanding of costs, we had to make sure that we were also understanding the benefits. And as I said before, our three kind of key areas were looking at teacher retention rates, teacher evaluation ratings, and student achievement. And as I said before, a key thing that we did in this study, and that IES requires, is that you focus only on impact findings that are the most rigorous. So even though we had some suggestive research findings in some of these areas that I'll talk about, we really wanted to focus on the ones that we could say were causal— that were shown by the randomized control study to really be a causal effect of the intervention. Next slide.

So as we said, one of the benefits that we were looking to measure was around teacher retention. And there's a lot of research out there that talks about how expensive it is to replace a teacher and it ranges anywhere from $5,000 to $20,000 a teacher, depending on the size and location of a district. But what we do know is teacher retention has huge cost nationally, with some estimates in the $5 billion range.

In this study, we didn't have a statistically significant effect when we look at the end of the two years on retention. Although, as we'll see in the next slide, there was evidence that the more hours of mentoring that teachers received, the more likely they were to stay in the district. And we'll see that in the next slide.

And what this shows is that the more hours of mentoring, you can see the curve going that mentees received increased their chances of staying in the district. In fact, the odds of a mentee staying in the district doubled with every additional 10 hours of mentoring received. And even one additional hour increased the odds of a teacher staying in the district by around 12%.

But since these findings were not causal, because these findings we're really only focused on the group of teachers that received the intervention, we did not cost out those benefits. And in

the cost benefit analysis, we excluded it. We only wanted to focus on things where there was a clear causal effect. Let's go on to the next one.

Teacher evaluation was the second. And we looked at the ratings from the teacher evaluation scores. And again, there wasn't a significant relationship found between the program and improved evaluations. So we didn't try and cost those benefits out either. Next slide.

Student achievement, however, we did find a significant impact on student math scores after one year, for students in the treatment group. And so what we were able to do is then take a look at literature. And there was a national study that actually links impact of increased math achievement associated with just a single year of instruction, that could be linked directly to increases in lifetime earnings and other social gains, including reductions in teen pregnancy and improved graduation rates.

What we focused on, because we had a rigorous study that showed an increase in lifetime earnings, was that piece. And this external study had looked longitudinally at the impacts on a single year gain in math to higher lifetime earnings. And even though we couldn't really cost out some of these other benefits, like reductions in teen pregnancy and things like that, we decided let's focus on what the difference in lifetime earnings associated with improved math achievement might mean, in terms of an overall cost benefit.

MARK FERMANICH:

All right, and so this is the key table to the whole study. So as we totaled up all the costs that Dale talked about and then also the value of these various benefits, and then rather than take taking them on a per mentee basis, we calculated a per student amount for both the benefits and the costs. And as Dale mentioned, we did this using both local pricing, which used the actual school district salaries and costs for other things, as well as the national pricing from the database that the Center for Benefit Cost Studies in Education has put together over the last number of years.

And as you can see, the national pricing is somewhat higher. So the first line is cost per student, $173 for local pricing, $239 for national. Then we figured out the federal fiscal benefits. For those students with higher earnings, they paid higher federal income taxes. They participated in fewer federal social support programs and that sort of thing.

And obviously, the benefits were costed using the same prices. And again, I think both of these studies were also conducted by Henry Levin and Clive Belfield at the Center for Benefit Cost Studies in Education. And the costs do not very between local and national pricing.

The bottom line is the key piece. So what we found is that for every dollar spent on the program under local pricing, benefits accrued to about $6.32. So a fairly significant cost-benefit ratio. A little bit lower for national pricing because the costs were higher while the benefits stayed the same. Next slide.

We also wanted to talk just really briefly— we wanted to look around at other research that might help verify the results that we found. And there was a study that we found that was conducted by Chetty, Friedman, and Rockoff in 2011, where they did a somewhat similar study, where they were looking more at the improvement in teacher effectiveness and what kind of impact that had over the lifetime of the more effective students. And essentially what they found is that there was a combined increase in yearly lifetime earnings of nearly $2 million across those students. And that over time, the cost of the program was exceeded by the lifetime earnings alone by more than 15 times or more.

DALE DECESARE:

And I think the last slide here— and we wanted to leave a little bit of time. I think we're pretty much out of time for questions. But as I mentioned earlier, the return actually could be higher if we could quantify some of the other benefits associated with this intervention, such as increased profitability of attending college, which the Chetty research found, or the reduced probability of teenage births and things like that, but we weren't able to do that.

So, what we did is used only the most rigorous approach where we could actually price out the benefits. And even with that, we found that the cost-benefit of this particular intervention seemed to be positive. So, I think with that— if there are any questions that folks want to ask?

And we really appreciate everybody participating, and taking our polls today and listening in. And we've got our email addresses up here. If you want to email us questions directly, we'd be happy to try and address those.

MARK FERMANICH:

And we also list a couple of resources. We know this is a 30,000-foot introduction to the whole concept. So if you want to learn more, there are a couple of resources that we provided there.

We do have one question if we have time to answer that. And it's for costs, are you measuring total or marginal costs of resources? For example, of teacher time or space costs.

So what we're measuring are the actual costs of the teacher dedicated or any staff person— the actual cost dedicated to the program. So if you had a teacher— if you figure 100% of their time, and they dedicated 1% of their time over the course of the year to the program, then we would take that pro-rated 1% of total costs would be both their salary and benefits.

Same for space. So if they use space— well, I guess, you'd look at space costs a couple of different ways. If they had to rent space, then we would just use the cost of the rent paid for the meetings. If it was district provided space then, again, it's a fairly complicated procedure.

But we would look at, okay, what was the total square footage of the room? What is the cost on average of square foot construction for a room of that sort? And then how much time did they use over the expected useful life of that building? So you may be talking about comparing

several hours to 30 years of time. So we did try to capture just those costs of things directly contributing to the program, itself.

DALE DECESARE:

Thank you very much for participating. And again, if there are any other questions, please feel free to email us and we'll be happy to answer them. And I think with that, we will adjourn since there are no other questions. Again, we appreciate everybody's participation. And thank you very much.

MARK FERMANICH:

Thank you for participating.