

Reading Development and Reading Difficulties in Children With Specific Language Impairment

Okay, thank you everyone for being here, and thank you Mabel for the invitation. I am just thrilled to be here. I've learned so much today and I'm just honored to be here speaking with people whose work I really admire and have learned a lot from.

So my work focuses on children with language and reading impairments; language and/or reading impairments. And I'm always straddling those two worlds. And so that's kind of straddling that line is the perspective that I'm coming from when I speak to you today. And also another possible difference between me and some of the other presenters is that I'm, I'm primarily focused on school age children. So typically the youngest children I'll ever be talking about will be in kindergarten, and often my current work is starting at the 2nd grade level, so often I'm talking about even a little bit older than that.

So to get through the disclosures, I receive a salary as a faculty member at USC. And my work that I'm discussing in this talk has been funded by NIH grants from the National Institutes on Deafness and Other Communication Disorders. And I received an honorarium for participating in this presentation.

So all of us are here because we care I think; I think we're all here because we care about kids with language impairments. And we care about language impairment because it increases a child's risk for other functional issues. So, we know that it increases their risk for reading disabilities, it increases, or they have a lower likelihood of educational attainment, and also reduced employment opportunities. And so a lot a times when we're making the case to study language impairment, that's where we stop. 'Cause we just say you know it's important to study language impairment because of these reasons. And what I'm gonna do is talk about how these reasons are associated with the disorder, or not associated with the disorder.

So in children with SLI, we do see academic difficulties. So we obviously see them in reading, we also see the in writing, in math, and in science, although there's been a little bit less work in those areas. But reading is special, because reading is one of the ways that, one of the primary ways that we learn about these other subjects, right, especially once we get past about 2nd grade. But the reading skills of children with SLI are not all the same. And so that's one of the things I really have focused on in my work is, is how are, how, what is the heterogeneity in those reading abilities and, and what does it mean, what does it mean when I say they're not all the same.

So I was a graduate student with Hugh Catts, and the Simple View of Reading was drilled into me, and it's been part of my work ever since. And so the Simple View of Reading would kind of give us a theoretical framework for how the reading disabilities of children with SLI are not all the same. So the Simple View says that you need two things to be able to comprehend a text. You need to be able to read the words that it contains,

and then you need to understand the message. And so by definition, children with SLI have difficulty understanding the message of a text, right, so they've already got a hit there, so they should have reading comprehension problems. But they may or may not have word reading problems. And so that's been a focus of my study since then.

So I'm gonna, so thanks to Hugh Catts, he gave me this slide as I was preparing this talk. These are; this scatter plot is from the Iowa Longitudinal Study. And this is showing you 4th grade reading skills of children who had SLI in kindergarten. And so on the X axis you have word recognition, and on the Y axis you have reading comprehension. And the first thing you might say when you look at this scatter plot is that these skills are correlated, right? That the, that you see a correlation between word reading and reading comprehension, and that's expected, right? Now all of the kids here have SL—had SLI in kindergarten, according to the Iowa definition. And this line here is one standard deviation below the mean on word reading. And what you see is that not all the children with SLI have word reading problems, if you define a word reading problem as one standard deviation below the mean. And you might say well yeah, but the sti—scores are still correlated, so maybe they're a lot or below average, but that's not the case either. So this blue line is showing you the mean, and we have plenty of kids with SLI who are scoring above the mean in word reading. Now if we take the same approach and look at reading comprehension, it is not the case that all the kids who had SLI in kindergarten have reading comprehension that's below normal limits, if we defi—define that as below 85. But there are not very many of them who are scoring above average, compared to the ones that are scoring above average in word reading. So this aligns with that simple view of reading where we can, we can be pretty sure that a child with specific language impairment is going to struggle with reading comprehension, but it, it doesn't always go back to a word reading deficit. And that's important, because we want to be thinking about the deficit, or the, the underlying factors that are causing the problem so that because different disorders require different treatment.

So today I'm gonna be talking about similarities and differences in research in passive tradition for spoken and written language disorders, and then I'm gonna be talking specifically about research on SLI and dyslexia subgroups. And I'm gonna push us a little bit towards the end of the talk to think about, so in the field of word reading, we're, if we're thinking about clinical practice, or, or practice, not necessarily clinical prac—practice, but in education, word reading is using a response to intervention approach to identify children that need treatment, and to provide that treatment. And so in the end of this talk I'm gonna be thinking about could that same approach help us in service delivery for children with SLI. And if so, what would we need to get there, what would we need to do in order to make that actually happen.

So, for the research and practice traditions part, I want us to be thinking about how both SLI and dyslexia have gone through a process, an evolution of labels. So they, they both have a history of evolving terminology. And we're gonna consider how each field thinks about the role of explicit instruction. Both have some advocacy work going on right now. And then we're, I'm gonna think about how practice and service delivery is currently happening in both disciplines.

So as I said, both disorders have had an evolution in their terminology. But there's a lot that's shared between the two disorders. So in both cases, we're saying that the disorders where we have evidence that the disorders are congenitally based, biologically based, and then the definition for each disorder is, is, is idiopathic, right? So it's, an e—a disorder in SLI, we have a disorder of language, of, of spoken, written, uh, of understanding and speaking, and in dyslexia, we have a disorder of word reading. And in both cases, those disorders are not explained by general intelligence, by sensory impairments, by a lack of stimulation or instruction, by an acquired brain injury, or some other known developmental syndrome or disorder.

And so as, as I mentioned, both, both disorders have seen an evolution in their terminology. And I've taken these terms from reviews by Dr. Leonard, and by Henry and Brickley for the, for the dyslexia terminology. But you might be interested to know that the first time dyslexia was used in the literature, it was actually used to refer to an acquired disorder. And also the first time that I know of that the term "specific language disability" was ever used in the literature was in 1950, and it was by a, a medical doctor named Gallagher who was studying children with dyslexia. So just kind of just some fun facts about the history of the terminology.

So moving into the role of explicit instruction. This is an area where the two fields are, are a bit different; the field of dyslexia versus the field of language impairment. So when we think about oral language, we think about typical development being fostered through communication experiences. It seems effortless that children acquire the language that they need to communicate. And when we see a disorder, we may use either an implicit intervention approach, or an explicit intervention approach, and sometimes whether we're using implicit or explicit depends on the domain that we're targeting. So for example, vocabulary interventions have both implicit and explicit approaches. Grammar interventions have largely been implicit, but people like Liza Finestack have been working on developing explicit approaches for teaching grammar.

We think about word reading; reading scientists generally accept that word reading needs to be explicitly taught. Now in practice, there's you know, reading words about that. But in, in science, we know that reading must be explicitly taught. And, and there's a common phrase that's used, that explicit, systematic instruction is necessary for some, it's beneficial for most, and harmful to none. So the recommendation is that we should have explicit instruction for word reading.

When we think about advocacy, from my perspective, there's been a longer history of advocacy around dyslexia, and there's a greater public awareness about dyslexia than there is about language impairment. And that advocacy has pushed for universal screenings in many states. I'm not necessarily advocating for that, I'm just saying that that's one of the, one of the results of the advocacy is that, is that there has been this mandated legislation. And we're now seeing advocacy around developmental language disorder, of which the, the primary groups of children in that category would still include children with SLI.

When we think about identification and service delivery, with oral language, we're still relying on a referral model for the most part. We, we ex—we wait for the problem to be noticed by someone, and then when the problem is noticed, then, then that person who notices it goes to someone else who might be an SLP, and then a te—testing is done. And, and once it is determined that a child has a language impairment, we intervene. And so if we're thinking about a response to intervention model, we don't really have one for language impairment, because intervention doesn't happen until a problem has been noted. So it doesn't even happen until, or till, till, until Tier Two. And we really place a lot of weight on making accurate decisions about yes or no. You have a disorder or you don't have a disorder. We talk a lot about sensitivity and specificity of our assessments for example. If we think about word reading, in schools, in practice, word reading is tracked primarily now using an RTI model. And in the ideal situation, an RTI model is a whole school framework, and it's prevention focused. And so there's team approach. So as, whereas with oral language, the responsibility is often in the hands of the SLP, when we look at word reading, there are many individuals who are responsible for serving the needs of developing reading abilities in children. And, and for word reading, we have, we should be having evidence based instruction and progress monitoring occurring in all tiers. So even as low as Tier One. 'Kay.

So with that background, now I'm gonna move into some of the research on SLI and dyslexia subgroups. So when I was a graduate student at Kansas, I had the opportunity to work a lot with the Iowa dataset. And we worked on this with this dataset to show that SLI and dyslexia are frequently comorbid, but distinct disorders. And we were able to do that because the dataset was longitudinal and had a lot of measures of each component. So it was a, a really robust dataset to look at this. But since that time, there have been lots and lots of—well, I don't wanna say lots and lots. There have been a good number of studies that replicate that finding. So, we recently had a couple of review papers come out. And so because there have been building studies, we now have really strong evidence that SLI and dyslexia are separate but frequently co-occurring disorders. And it's important to know this because different, the different defining features, so the word reading problem, or the oral language problem requires a different treatment. But there have been, even though there has been emerging evidence that they're different disorders, there have been relatively few studies that directly compare the individual deficit subgroups. So SLI that occurs good word reading, compared to dyslexia that occurs with good oral language. And so the existing studies that are there, have a, have really focused on establishing that these disorders are different, or because of a theoretical question that was being asked at the time there've been a lot of studies that examine the role of phonological processing in each disorder. And so that work is a little bit squishy, to use Sean's term. But what we can say about it is that phonological deficits are more severe in dyslexia than in SLI only. But depending on the study that you look at, and the timepoint that you're looking at, you may see subtle differences in, or subtle deficits in phonological processing for the SLI group. They're not always different from dyslexia, but sometimes they are.

Beyond phonology, there's been a handful of studies that have looked at syntax, showing that children with SLI perform worse than children with dyslexia in syntactic skills. And then there's been work by Shelly Gray and colleagues that have looked at working memory and word learning, in children who have dyslexia, or who have dyslexia with a language impairment. And in those studies, they found that children with dyslexia, or even when they don't have a language impairment, are still having problems with word learning.

So I'd like to take a minute to share some work from our lab that has been looking at these subgroups, where we're looking at all four groups, at academic achievement and word learning.

So in this first study that I'm gonna talk about, we're looking at academic achievement. And so, most of the research on academic achievement in children with SLI or children with dyslexia hasn't really looked at the comorbidity. And so we had, we had the question, well what do these kind of research based profiles, what's the functional impact of it. And so, we wanted to know how does each subgroup perform on school measures of academic achievement when they're administered between 2nd and 4th grade. And so this is a longitudinal dataset from the, from South Carolina, where kids were enrolled when they were in 2nd grade, and then they, we have their school measures from the measures of academic progress. This is a, this is a, um, a, a... sorry, computer adaptive assessment, that's given as a kind of a benchmark. So it's given twice a year, fall and spring every year, and we have the data from 2nd to 4th grade. At the 4th grade timepoint, we have quite a bit of missing data, but we had enough that we were able to do growth curves. And these are global measures of reading and math achievement. So in the reading measure, the items include both word reading items and comprehension focused items, and in the math, you've got both numeracy and problem solving.

And so in this, in this analysis, this is not an SLI group, this is more of a DLD group. We have not put in a criteria of low non—or, of good nonverbal IQ for this analysis, because we are interested in the functional impact. So that was the decision making process here. But we have 475 kids who enter in 2nd grade, and then we follow them 2nd to 4th grade, and they have fall and spring assessment. But so subgroups here, in—so if you look in the bottom left, that would be the Both group; they have both poor language and poor word reading. And in the top right, you see typical development, so that's, and we just use an arbitrary cutoff as 85. So typical can be a score of 86, but you have a typical score in both, in both components. And then in the top left is dyslexia. So you have good language but poor word reading,. On the bottom right is, language impairment only, where you have good word reading, but poor language.

So I wanna just look at what do these kids do when they're—So in, these are not kids who have been identified in schools, these are just our research based measures. So how are they doing on school measures of achievement. And what you see here, uh, top purple lines is the growth curve for the typically developing group, and the bottom one is the, for the Both group. And then in the middle what you see is that the LI and dyslexia groups are almost completely overlapping. Now all of the disorder groups are sig—are,

are performing significantly worse than the typically developing group. And what you also—also should see is that that gap never closes. So the gap that's there in 2nd grade when they're enrolled in our study, persists all the way to the last measurement point.

And, and it's not surprising that the dyslexia and the LI group would be overlapping, given that this is a global measure of reading. So if we go back to the simple view, each one of those individual deficit groups has one hit in the simple view. One as a hit on word reading, one has a hit on language, and so that creates this kind of like overlapping performance on this global measure.

We see the same pattern for math performance. Although the gap between typical and impaired is a little bit less than it was for reading, we still see that these kids are performing significantly worse in math from the earliest time point, and that that gap never closes.

So, we see significant differences between typically developing kids in all the subgroups. They're present as a study entry in the fall of 2nd grade, and the impacts are the worst for the, for the Both group, and the gaps persist through spring of 4th grade.

So now I'm gonna shift. So that's kind of just like these, these groups are functionally relevant. And now I'm gonna shift to word learning. And so in the word learning work, I'm actually interested in more theoretical questions about what does it mean to be SLI and what does it mean to have dyslexia when it comes to word learning. And so in this case, this, this study is ruling out nonverbal IQ. And we also apply a buffer zone. So we want homogenous groups. So we don't want somebody that has a score of 86 going into the typically developing group. So it's the same kids here. But those yellow dots are kids that are excluded. So if you're super normal, so if you have a standard score above 115, you're out, and then if you fall between 85 and 90, which is a, a 16 and 25th percentile, you also are excluded from the analysis.

Okay. And so, just like Dr. Leonard was saying earlier, these were the; so the South Four, and the Woodcock Reading Mastery Test 3, word reading assessments, were the ones that were used to define the subgroups. And these measures were not part of the definition that kind of provides validity for those subgroups. So on the left I have the test of word reading efficiency, which is the word reading efficiency measure. It's very similar to the Woodcock Reading Mastery Test, except for that it's timed. And what you see is that the profiles there are exactly like they were in the scatter plot that I showed +you, so that kids with dyslexia and kids with combined LI and dyslexia are scoring poorly, but the kids with SLI are scoring just fine. And then what you see for vocabulary is that, is that kids with SLI or combined SLI and dyslexia, are scoring in the low average range, not necessarily the impaired range, but the low average range in vocabulary. Whereas, the kids with dyslexia are scoring above average. Mokay.

So going into this study, our very simple hypothesis was that word learning would be difficult for kids with SLI and kids for dyslexia—with dyslexia, but for different reasons. So our, and, and, the hypothesis actually doesn't matter so much for the purpose of this

talk, but I just wanted you to know, we expected that kids with SLI would have trouble with word learning, because they have semantic deficits, and that kids with dyslexia would have trouble with word learning because of phonological deficits. And, that didn't quite come out that way. So we taught 8 novel words to children, and they were aired with novel objects that you see below. And when the children were taught, they were taught the category name, and they were given two visible and 2 invisible features for each item. And, I had a script, which is, I hid the slide, but I should pull it back now. This because it, it... matters after hearing Dr. Leonard's talk. So this is the script that was used on the first block of teaching. So we teach the word; you get 8 exposures to this—in each block you get 8 exposures to the spoken word form. And, and, and you have opportunities to... say the words, and to recognize the referent within the teaching script. Now that's the first block. And so in that first block, the retrieval practice has a, has an interval of zero, 'cause I've just told you all about the word, and now I've asked you what is it called, and, now you say it. So, and, and find it. And so that all happens in the first block. Now in, in the next blocks of teaching, the retrieval practice, actually one, either the naming or the finding, happens at the beginning of the block, and the other happens in the middle or the end of the block. And we did that, just because during piloting we found that when the interval was zero, kids were like "Why are you asking me these questions I already know?" But when we changed it, and we, and we asked 'em at the beginning of the block, they realized they didn't know, and they paid attention and they learned better. So we were, we used the space for retrieval on purpose, because we were trying to get kids to, one, pay attention, and two, learn the words a little better.

And then we had 5 assessments of word learning. And these, these assessed both recall and recognition of the item. And, for the reco—for the semantic recall, we have versus a verbal and a nonverbal task. So we have a drawing task, and a describing task.

And, so I told you that we, we kind of thought we'd see this difference in ph—phonological versus semantic aspects of word learning. And we didn't quite see that. So, so this is the phonological form. And what you see here is that the dyslexic children are performing worse, significantly worse than typical developing children, and the combined dyslexic and SLI subgroup performed significantly worse than typically developing children. And then if you move to phonological recall, you see that same pattern, and then you also see a new significant difference which is that the SLI group is performing better, significantly better than the Both group.

Now if we go over to semantic recall, we see that same pattern. Notice that the SLI group has not differed yet. In the 3 that I just showed you, they haven't differed from typicals. They do differ from typicals in the verbal semantic recall, but they don't differ in semantic recognition. So across 5 tasks, the only time that the SLI only group differed from typicals was in the, verbal semantic recall. And so I've plotted the effect sizes here. And so the purple effect sizes are just looking across tasks. You see the, the typical group versus the SLI group. Those are the effect sizes. They're in the moderate range, but they weren't statistically significant in our model. The Both group, you see 'em in the moderate to large range. And then, and then in, if you compare SLI to dyslexia, although when you control for the unequal sample sizes, there weren't a lot of significant

differences. You actually see that the effect sizes are almost as big as the effect sizes for TD versus SLI.

Okay. And that's surprising, right? So, it's surprising that the children with SLI only are performing better than the children with SLI and dyslexia, given this vocabulary profile that you saw before. Right? So the kids who have SLI are, have poorer vocabularies, but are learning words better than the children with dyslexia. So, we're, we were really surprised by that, and have a lot of new studies ongoing to try to kind of understand why that's the case. How you can have this vocabulary profile, given the word learning profile. But I think if we think about the results that Dr. Leonard shared earlier, and we go back to that path right, that we used space retrieval, and we used with very explicit instruction. And so this, you know, we used the principles of, principles of good instruction in learning sciences, to try to get kids off the floor. And, and that might have worked for the SLI kids, right? And then also if you think about the fact that the task is very verbally loaded, that may explain why. So everything relied on phonology, and, and it was very just, you were learning because we asked you to learn, there wasn't a real other reason to learn these words. That may explain why it was a little bit harder for the kids with dyslexia. But all of this needs to be studied in the future.

So children with SLI and dyslexia displayed different word learning strengths and weaknesses. But children with SLI actually showed milder word learning difficulties than children with dyslexia, and that surprised us. But they showed their greatest deficit with the verbal semantic recall. Children with dyslexia displayed difficulty across all word learning tasks. And that's actually consistent, fairly consistent with the results that have come from, from Shelly Gray, and Mary Alt, and Tiffany Hogan's work on word learning. Yet these children with dyslexia had significantly higher vocabulary achievement and general language abilities than the kids with SLI. And then the kids from the Both group, have the worst word learning across all tasks.

So I think these results highlight the importance of studying SLI and dyslexia, and dyslexia groups separately. Because if you hadn't separated that out, you would just say, oh, they all have trouble with word learning. And they d—they don't have the same kind of trouble. We need more studies to examine why kids with SLI struggle with word learning to examine how children with dyslexia develop such strong vocabularies despite their word learning difficulties. And I think these results speak to the potential promise of explicit and systematic vocabulary instruction for children with SLI. But we need to know like to what extent are words retained over time. Our testing point was just right after the word learning instruction. And we also want to think about if we keep going towards practice, how do we maximize word learning to close vocabulary gaps.

Okay. So, that's kind of my research part as far as theory. And I hope, hope I've shown and made the case that we need to be looking at these groups separately as well as together. And so now I'm gonna move into kind of this identification and service delivery piece.

Okay. So SLI and dyslexia are different disorders. They redi—require different treatment. And yet we have a lot of evidence that many children with SLI fly under the radar. And so we have evidence from other labs showing that racial and ma—ethnic minorities, children who have lower socioeconomic status, whose parents had lower caregiver education levels, a lot of the stuff that Sean Redmond was talking about earlier, that those kids are less likely to be... on caseloads, as having SLI, than children who are showing opposite profiles. And then from the work that I've done with Hugh Catts, and as well as the work that we've done in South Carolina, we find that children with good word reading skills are also more likely to fly under the radar. So they're less likely to be identified.

So, thi—I'm gonna show you how we've shown this in South Carolina. So, when children are... enrolled in our studies, there's a very short parent survey that just asks parents, does your child have a history of any kind of speech, language, reading, or other special education services. And what you can see here is that very few typically developing children have any other prior services. And when I say typically developing, I'm talking about based on nonverbal IQ—oh, no, this doesn't include nonverbal IQ. I'm talking about just word reading and, and... and language ability. In the DLD only group, we see more children have had a history of services, but it's less than children in the dyslexia only or the combined group. So that's on a parent reported history of service delivery, any kind of service at any point in time. When you look at the services that parents report, it's primarily speech, like articulation, for all groups. And then if you look at parent concern; so then we say "Do you have any concerns," the first question is, does your child have a history of ever receiving services, the second question is, do you have any concerns about reading or language skills. And it's just open ended, but we code all the responses, so that's how we know. Uh, again, if they have a concern, it's usually about reading in this case. And so, but if you, but this kind of pattern mirrors the pattern before, well actually almost mirrors it. But what you see is that the DLD only group has the lowest percentage of parent reported concern. And some of the parents who report concerns are also the parents who report prior services. So if you combine those two things, and you say, did you say yes to either or both of those questions, you see there's a significant difference between the DLD only group and all the other groups. And so they're, they're more likely to have concerns than typically developing kids, but significantly less likely than kids who have a reading problem. So parents are in tune when their kids are, well, the, the kids who have dyslexia are still under identified, yet, the, the, they're less likely to be, or they more likely to be identified than the children with SLI are.

Okay. So why? Why is that the case? Why do they fly under the radar? Well I think, or we could all speculate. But I think one it's kind of hard to differentiate between normal and impaired development of language without direct measurement. So language is kind of invisible, and, especially the kinds of language structures that we need for academic language. So, those kind of complex syntactic structures that occur in lectures like this but not so often in conversations. And then also efforts are infrequent, even for children with SLI. So children with SLI make more errors than all the other kids, but they don't make errors all the time, right? So the majority of what they say is grammatically

correct. And also the range of normal is really wide. And we don't see that unless we are actually measuring it. So the range of competence in children with typical development is really big, even though the range of use in conversation is much smaller. And I'm gonna show you an example of that later on.

And so I think RTI could help address some of these issues as far as identifying children and making sure that they get services. And so, so, now moving into how could it help, and what would we need to get it started. And I just kinda wanna make sure that we're all on the same page about what response to intervention is.

So a response intervention model, in a response intervention model, both assessment and intervention are integrated in a multilevel system. A response intervention models prevention oriented, and so there is a universal screening and progress monitoring. The goal is to catch kids before they fail. All kids are expected to have evidence based instruction and progress monitoring. So everybody is in response to intervention. Even though sometimes in practice we hear those terms used, like oh he's in RTI, to mean he's in Tier Two, really if a school is using an RTI system, the school, everybody is in RTI. So everybody starts at Tier One, and everybody receives evidence based instruction and progress monitoring. And the progress monitoring is important, because a lack of progress signals the need for an instructional change, or an intervention change. And then as you progress through the tiers, you're getting an increased intensity of intervention, and increased frequency of assessment in the higher tiers.

'Kay. And those percentages are just guidelines. So they're not, um, you know, it, it's not the case that in every school, 80% of kids are in Tier One, it's a guideline. So the benchmark is determined based on either local norms, or national norms, or both. And, where kids fall in the tiers, may be different in different schools.

So... so... so what do we need to think about applying RTI to language impairment? Well first of all, we would need measurement. So we need to, we need increased research on measurement. So we have... existing screens of language ability, but, the existing screens that we have provide; are not really intended for use as a universal screen. So a universal screen is one that's given to everyone in a school or classroom, right? And so, we don't really have the kind of evidence that we need from the existing screens to say that they would be very useful in a universal context. Some manuals provide sensitivity and specificity for a wide age range, but sample sizes for ages within the range are small, and so it's not always clear that the same sensitivity and specificity would apply to all the different age points. And, as, I think it was Sean Redmond talked about, yes, it was; they're often tested on clinical versus nonclinical samples. And so that can overestimate the classification accuracy when you see it as a universal screen. Because all those kids that are kind of in the middle, have been left out of the analysis. So we need more research here, like the kind that Sean was talking about earlier today.

My lab, because we're interested in finding these kids to study them in subgroups, we have also been engaged in working on... on universal screens. And this is kind of just a byproduct of our work, trying to find the kids that fall in these groups, and trying to find an

efficient way, because we are very thankful to the schools that work with us, that they allow us to come in and screen all their children, we wanna get in and out as quickly as we can. And so we worked on group, uh, developing group screening procedures, and we've kind of iterated on this a few different ways. So, existing screens currently are individually administered. The time for a participant may be low, but the time for a universal administration, if you think about all the kids, and, and the scoring for all of the kids is quite high. So what we've kind of asked is, if we could maintain a good level of validity and reliability, then, would group administers, then maybe group administered screens could be more time and cost efficient. So our goal has been to administer one screen to the whole class in the same amount of time that it would take to give a screen to a single student. And hopefully not increase the time required for scoring.

And so our first study, of, in our first study like this, we administered language and reading screens to about 1500 2nd grade children, to identify those who would be at risk for DLD, dyslexia, or both. And so we used two measures. Our reading screen, and so this is in 2nd grade, our reading screen was a test of silent word reading fluency, and our language screen, because there was no existing group administered language screen that we could use, we used the listening comprehension subtest of the grade, which is a reading assessment. And so this was a sentence/picture matching task. We thought if, and it, and it, it claims to test syntactic construction, and to hold vocab—I, I don't remember what they said about vocabulary. So we thought sentences was a good place to go for finding kids with language impairment, and this was a prior, a preexisting measure, and so we used it. And 381 of the screened participants, participated in individually administered follow-up testing to establish the research groups and evaluate screening. And so it took about 5 minutes per student to score all the assessments.

Now this data is showing you the sensitivity in, that we used (sounds like fraught curves) to identify cut points. This is showing you the optimal cut point for the combined screen. So I'm, I'm combining data from the reading screen with the language screen. And what you see is you get a decent sensitivity for identifying a child who's at risk for anything. So, are you at risk for DLD, or dyslexia, or both; it doesn't matter. 80% sensitivity you have something. And then we looked at the false positive rate. So 24% of children who are identified don't have a problem in any of those areas. And this may sound high, but remember, I have used an arbitrary cutoff here of 85. So if you have 86, and, and I, and I said you were impaired, then I, then...then I'm wrong, right, in this analysis. So this is a conservative analysis. And, but, and then what you see now is the false negative rate for the individual difference groups. So, or for the, indi—individual deficit group. So the miss rate is highest for kids who have DLD only. But it's still much better than... relying on parents to notice the problem, or the school to notice the problem and, and to intervene, and receive services. So, although this isn't like ideal, it's much better than current, current status. And then the miss rate is lowest for the Both group.

Okay, so that was our first study. And, and in that study, we demonstrated feasibility of group administered screens. And so like the classification accuracy was, was acceptable for an RIT procedure where... the... you, you know, after RTI—so if you fail a screen, you're gonna get more attention on you. So you're gonna get either more instruction or

you're gonna get more asse—more frequent assessment. So, it's not necessary that you're gonna get a label, but you're gonna get some more attention. So, in that situation, a false positive is not as big of an issue as a false negative. So, we felt like it was, you know, feasible to do these screens. So classification accuracy is acceptable, but we wanted to improve the accuracy for the DLD only group, and to identify kids with this profile at earlier ages.

So we did another study which came out earlier this year, that was led by Allison Hendricks, who was a postdoc in my lab. She's now at the University of Buffalo. And in that study, we used... items from TROG. And we, we used a selection of items from TROG, and administered those as a group administered screen. And in that study, so, a single measure, we didn't have to have a combined reading and language measure, but a single screening measure was feasible for both 1st and 2nd grade students. It approached acceptable classification accuracy for DLD overall. So 76% sensitivity, 25% false positive rate. But this was with a single measure, not needing the word reading measure. But again, sensitivity was a little bit lower for the kids who had DLD, with average word reading skills, versus those with poor word reading skills

We have a new screening study in progress. So we've developed our own set of items, and we've administered it to I think 700 kindergarteners and 700 2nd graders. We've established that it's feasible to, to screen kindergarteners in this way. And we see a pretty good vari—we went through several iterations of the screen, and in our last iteration, we see pretty good variation in the screening measure, which makes us think that we'll have pretty good classification accuracy, but you'll have to stay tuned for those results.

So what are the benefits of universal screening or assessment? Well number one, you would find kids who would otherwise be missed. Number two, I think another really good advantage that, that only occurred to me fairly recently, is just that you have direct knowledge of the range, the full range of typical development. And so this comes back to this idea that the range of competence is big, even if the range of use is smaller. And so as a, as a kind of anecdotal example of this, we were presenting to the South Carolina intellectual, uh, sorry, International Dyslexia Association, about a month ago, and we were presenting information about our screen. And so we were showing that a (inaudible words) picture matching task, and in this example, we say you know, this examiner reads "The boy who plays basketball is not tall." There's no print on the assessment, this is just what the examiner reads. And the child's asked to select the correct picture. And someone in the audience said "You gave that to a 2nd grader?" And, we nicely said yes, and moved on. But, no, yes, we gave it to a second grader. We also gave it to kindergarteners, and almost all of them got it right. Or a good number of 'em got it right. So, I think we don't think about how much typically developing children can do, and how wide that range is in our kind of like every day thinking, where we're just thinking about if this could be impaired or not. But, the difference between the child who's at you know 84, is quite different from a child who's at 100, right? And so, the benefit—one of the benefits is that you kinda get to see that. We see that in RTI, we see that with reading fluency. So, I had an example at the end, but I, that the sound file won't work for, but I can play for you in 8th grader, who's doing a fluency task, and reading along, you know,

on (sounds like, my be old worn bone). And this is, these are items from the TOWRE. And they kind of read very methodically. And you think well they're accurate, and they're reading you know a little reo than a word per second, so by the end of the task, they've got 60 something words in 45 seconds, and you think that sounds okay, it sounds like he's a good reader. That's a 8th grader. And then I played for a 2nd or 3rd grader who reads 80 something words per minute, and you realize wow, okay, that's very different. And so by kind of measuring everyone, we kind of have an idea of what the range is.

So our, so, so I think one kind of thing that we need is, is to develop measurement for screen procedures. We also need to develop measures that could be used for progress monitoring. So if we take a word reading example, in kindergarten; so kids are being RTI'd for reading, you know beginning at kindergarten now, right? So they're getting progress mon—the—screening and progress monitoring beginning in kindergarten. And we know that we expect floor effects when kids start in school, they haven't been taught yet. And we, we know that explicit instruction is required. So we expect floor effects early on. But what happens is when we do repeated progress monitoring, we can see change in the progress. And, and someone who's making slower progress, that gives us better ide—a, a more, um, confidence that this is a problem that needs to be attended to. So I've just kinda plotted some hypothetical kids here who are hypothetically in 2nd grade, and a common end of year benchmark for 2nd grade would be 100 words correct per minute at the end of 2nd grade. And so you can see that you know Student B, I guess there, is, you know on track, right? They're kind of average when they begin, and they're on track to meet that benchmark maybe even early. The second student, I don't know what color it is; think it's black, for this we had—Anyway, this student here, you know starts off pretty low but makes really good progress, so we're not concerned about 'em. And then, but this last student down here starts off low and is not making progress. And so we would see that we would wanna intervene for the student because they are not making that expected progress. So if we wanna apply that to language, then we need to have some measures that are amenable to progress monitoring. So we need things that have items that you know, that, sets of items that are equally difficult that can be given over and over, that can be, that would change, that would have a, a rate of change that would be measurable. I think language sampling might be one that we could look at, although it's time intensive to transcribe and score language samples, and I don't know that we expect, I don't know how much of change we expect. But if we think about the kind of careful work that Pam Hadley was doing, looking at structural changes, that might be something that we could look at in, in terms of a progress monitoring. She was basically doing that just for younger kids; that's exactly what you were doing.

We also have the narrative language measures that Spencer and Peterson have developed. So they have multiple equated stories that can be given over time. Those are intended for progress monitoring, so at least for narrative language skills we have measures there. But we need more research in this area.

We also need research on treatment dosage and intensity. I'm gonna take a drink a water. So, so we know in intervention works, we have a lot of, we have now been building our intervention research in this field. So, so we might say, well this intervention works

compared to business as usual. But now we need to be thinking about well what's the expected rate of change in response to this evidence based intervention. How do I know if a child's making adequate progress? And then, and so what intensity of that intervention is needed in order to meet the benchmark or close the gap between a child with a disorder and a, a child who's typically developing.

I think we have some kind of beginning examples of this from Holly Storkel's work on, on vocabulary intervention with kindergartners with SLI. So she's been looking at you know how much instruction is needed to; so what is the dosage and what is the dosage schedule that's needed. And she's shown actually a plateau, like after you reach a certain amount of instruction, then the, um, then the inter—then the effect is, plateaus. So we would know we would need to think of some other intervention at that point. But again, this is an area where we need more research as well.

Okay. So I've kinda sped through this. But so closing thoughts. Challenges and opportunities for future research. I hope today, after listening to this talk, that I, that you have come away with the idea that SLI and dyslexia are distinct but overlapping disorders. You know, this finding has been out for a long time now, but there's still relatively lit—little research on it. It's important for us to at least account for this comorbidity in the research that we do, so that we know who the results generalize to. Right? Who are we talking about when we see this effect? Children with SLI who have good word reading problems may be more likely to fly under the radar, yet they still experience significant reading comprehension difficulties and impacts on other academic skills. I showed you that with the reading and the math on our academic achievement paper. I think, that if we think about practice, SLP's can borrow some of the approaches that have been used from researchers and practitioners who are concerned with dyslexia. So, to do this, we could continue to raise awareness about the impacts of the disorder, and we could consider RTI models for identification and service delivery. I don't think we're ready to just implement that right now. But I think if we focus on that as a long term goal, there is some research that we could to get there. So more research is needed to build that infrastructure.

And I just wanna thank a lot a people. So my lab leadership team has heard me pitch some of these ideas in different variations over the last few months, so I'm really thankful to them. Our research assistants who've helped us do this work, the schools and parents and students who participated; collaborators who've also heard this pitch and, and given some feedback, and then the funding from the NIDCD. Thank you.

MARGARET: Alright. Well, in our tradition here, if there are any research mentoring pair proteges who have yet to ask a question or might have one. Oh wonderful. Just takes a little encouragement.

Q: Hi, Jason Chow, Virginia Commonwealth University here with Dr. Schuele. So, my question is sort of following up on that idea of RTI or MTSS process in sort of applying, applying screening for language on it. So, you talked about . . .

SUSANNE ADLOF: I'm sorry, I'm havin' a hard time hearing you. Can you? Yeah, thank you.

Q: Sorry, yeah. So when you're talking about, you know, universal screening and, and identification and progress monitoring, you were mentioning a lot of these issues about measures what we need. But I was wondering your thoughts on who you, who you thought was involved in the process in, in your ideal system as far as who's conducting the progress monitoring, who's, and who—so the classroom teachers are doin' the screening ideally, could, or at the classroom level. But who, how do you see that process moving as far as progress monitoring and using those data? So who's making the assessments and the decisions?

SUSANNE ADLOF: Yeah. I, I don't have; so I think your question was who's responsible for the different parts of the RTI system, when we're thinking about oral language. And, I don't have an, a ready answer for that. Like I; that's why I said I don't really think that we're quite ready to do this right now, but I think if we thought about the potential, we could go there. So I think you know, there's lots of different ways to solve the problem, but we need, we need the research first, yeah.

Q: Hi, thank you for the talk, it was great. The; can we; can I see the comparison between the receptive and expressive scores?

SUSANNE ADLOF: For vocabulary?

Q: Yeah, for vocabulary.

Q: Yeah. The one; the question that I had is, what about... the comorbidity between SLI and dyslexia? This is kinda hard to phrase I guess. What about that comorbidity makes it such as a severity of comorbidity is so much worse than just SLI by itself and dyslexia by itself?

SUSANNE ADLOF: Um... I don't know that I have a—So, I think this is, this is what you wanted to see here?

Q: Yeah. So, just as like a, kind of, I guess an ide—like a... a, for this first one, like we see that SLI and dyslexia together are, are half that of just dyslexia and much, much, much less than that as SLI. And even then for SLI and dyslexia in the other two, they're a little bit closer to the other SLI and SLI and dyslexia, so SLI and comorbidity. But, you still see like there's just a much worse effect. So when one, which end of that do you think; what's that a symptom, or, which dis—which disorder, as if you could separate them I guess, which disorder is contributing more to this? What underlying symptoms of a disorder is contributing more to this I guess? Be more . . .

SUSANNE ADLOF: Well, I think the question of which disorder is causing that effect is why we wanna study the groups separately as well as together, so that we get that idea. As to why the combined group; so in, in each case, right, we see that the, that the

individual deficit group performs a little less than typical, right? And, I think that's kind of regression to the mean a little bit. But, but in, but there is a distinct difference as far as the individual dis—deficit group. So in the case of the word reading measure, the SLI only group is still per—is performing, although slightly less than typical, they're well within the average range. So it, so it seems to be that for the, both groups, the reason they're poor in that measure, is because they have dyslexia. And if we look at vocabulary, we, it's not uncommon to find that kids with SLI are not impaired in vocabulary, but they usually perform in the low average range. Whereas kids with dyslexia are performing above average. So even though they're less than typical, it seems to be that the, that the language impairment is what's driving the language, is the vocabulary difference. That, that would be my interpretation. And we do see in the, in the Both group, if you look at the scatter plot, that we do have more kids that are just kind of trailing down when you look at the both. Like so there's a kid down here for example, right. So the, so we do see kind of like a, a greater spread at the low end, when we, when we combine the groups. Yeah.

Q: Thank you.

Q: Hi, I'm Alison Hessling, and I'm here with Dr. Finestack. And, I was thinking along the same lines as when Jason came up and posed his question. And thinking that an RTI model would lead to maybe collaboration between teachers and SLP's. And it seems maybe a lot a times teachers are also at a loss of really understanding and recognizing language impairment. So do you think, again in an ideal world, if that were adopted, it would have the potential to kind of close the gap, and open an opportunity for SLP's to share some of that expertise, so that educators could take on a more active role in helping at that time?

SUSANNE ADLOF: Let me make sure I heard you correctly. So I think you were asking, you, you were asking if we educated teachers better, would they be better at noticing and referring kids for a language evaluation. Was that what you were asking?

Q: And actively involving them, then, if this RTI model were universal.

SUSANNE ADLOF: Oh. I think it would be really, really nice to involve—uh, good. I think we should involve chil—teachers in an RTI model, absolutely. And I think we should raise awareness and make sure that people are aware of language impairment and its effects, absolutely. I'm not so sure that raising awareness means that more kids get identified, without measurement. That's, that's just my own hypothesis. But it's a, you know, even just from becoming a mom and having my own kids, like, I look, and I, you know, I don't know how they're performing come—I mean I have kind of a general sense, but it's hard to track these things in real time, unless you like recorded it and transcribed it and compared it to a set of norms, right? So, a child can communicate conversationally. They get their meaning across. We; and then if they're not so expressive, it could be for a lot of reasons; they're shy, they're tired, they're not interested. There's lots of reasons to explain why a kid is saying a little less, or not quite,

you know. So we don't really; and I feel like we don't have a great way of knowing, unless we actually measure. That's my personal stance.

MARGARET: Are there any questions from the general audience that are very specific to the data that Dr. Adlof has presented? 'Cause we're about to go into a panel discussion for the big teacher questions. But if there are any, we do have time, so I would welcome questions from anyone about this presentation in particular. Okay, I have one. (Everyone laughs) Yay! I get a moment.

SUSANNE ADLOF: I didn't hear anything you said, so. (Laughs) Okay . . .

MARGARET: That's okay, I'll just ask a question and you'll hear this. So, can you go to the data where you showed the parent ratings and the teacher ratings? There was one portion of it that was... it, it didn't make sense to me. So, go there so I can remember it better too.

SUSANNE ADLOF: 'Kay, sorry. That one?

MARGARET: Yeah, flying under the radar. And, I'm sure you've looked at it, but it makes no sense to me given the data of the combined disorders having worse scores pretty much on everything, that the parents were showing less concern than the dyslexia only group.

SUSANNE ADLOF: Yeah. So, the, um, yeah. So the... these are 2nd graders when they're enrolled. And so, in 2nd grade, we, the Question One is, is very open ended. We ask more specific questions in the later studies. But in this study it was just "Has your child had a history of speech-language or reading services, or other special education services?" And then the second question was, "Do you have any concerns about speech-language? And if so, what, what is the concern?" And so these are 2nd graders. And so and the DLD only group is performing well in word reading. Right? So they're, they're not getting... flagged yet by... any kind of school,. Like nobody's, nobody's picked up on an educational impact yet. And yet we know from longitudinal work and everything, that this is going to show up. I wish that we had earlier timepoints on that academic achievement. The first time that they give it is in 2nd grade, so I don't have earlier. And also, I could tell you, so, so basically what I think it is, is that parents don't see any impact yet. And kids are conversationally getting their points across and things like that. If they see something, they haven't, they're, they're not concerned enough to write a concern on a, on a intake form. I wanted to show you this. So in this, in these growth curve models, we don't, this difference is not significant. But if you... only...if, if, so in these growth curve models, there's no interaction. So there's main effective group, main effective time, and no interaction. But if you only compare them at this point in time, this difference is significant. So the LI group is significantly better than dyslexia group if you only look at that one point in time. But because of an overall analysis, you don't actually look there. So these kids are actually a little bit better until they get to, you know, so in 2nd grade we're kind of, at the beginning of 2nd grade we're still, still move, we're moving from this focus of instruction on word reading to this, to this expecting you to

read words accurately and fluently, and now expecting you to comprehend. So I think basically parents aren't concerned 'cause they don't see any educational impact yet.

MARGARET: Thank you.