IGDI-APEL Theory of Change

We expect *IGDI-APEL* to enhance early childhood professionals' ability to (a) implement assessment resources needed for RTI, (b) examine and utilize data in real-time interactions and (c) provide evidence-based intervention resources to connect data-based decision with realistic procedures for instruction. In this way, *IGDI-APEL* will expand teacher capacity to maximize all children's language development and resulting school readiness and reading ability. The logic is simple: to the extent that better assessment information can be provided more easily to preschool teachers, they will be better able to allocate, and provide, effective intervention services within an RTI framework.

Our theory of change rests on effects at two levels. First, through increased efficiency and ease of use that results from the technological features of this project, teachers will more frequently complete basic assessments and more fully use the results of these assessments. When teachers have access to frequent and robust student data through immediate real-time and user-friendly technologies they are better prepared to intervene and prevent early literacy difficulties. At the second level of effect, this increased use of data will better match instructional resources to individual children's need, resulting in accelerated development and achievement. In particular, our theory of change posits effects through sustained change in teacher behavior, and a resulting change in child educational services. Conceptually, *IGDI-APEL* is supported by three theories of learning and behavior. At the proximal level teacher behavior is viewed within the context of Ashton and Web's model of teacher self-efficacy (1986) and Nevin and Grace's presentation of behavioral momentum theory (2000). At the distal level, student learning is theorized via Vygotsky's Zone of Proximal Development (ZPD).

Proximal Support: Adult Learning and Behavior. Building on Bandura's social learning theory (e.g. Bandura, 1977;1993), Ashton and Webb (1986) suggest that self-efficacy is particularly important in that it mediates teacher's ability to improve student performance. More specifically, "teachers who have high levels of self-efficacy feel accomplished, feel responsible for their students' outcomes, set higher expectations for their students, and have strategies to achieve desired goals and believe their behavior directly impacts student learning" (Ashton, 1984, p. 29). Teachers who perceive themselves as efficacious will dedicate more time to educational goal setting, instruction and intervention to support student and classroom goals (Bandura, 1993; Barnes, 2000;Gibson & Dembo, 1984). By providing teachers will real-time student data that is presented in easily interpretable and meaningful ways, *IGDI-APEL* will facilitate this cycle of success by offering teachers a framework to interpret information that can directly inform their practice. In particular, *IGDI-APEL* will make it easier for teachers to complete sophisticated assessment and instructional decision-making tasks, and reflect on the benefits of this behavior. As a result, we expect teachers to increase their perceived self-efficacy through ongoing use of *IGDI-APEL*.

However, self-efficacy will not sustain increased assessment data-based decision-making alone. Where self-efficacy represents an intrinsic motivation for teachers, behavioral momentum integrates external reinforcement to maintain the cycle of success. Behavioral momentum theory suggests the rate of a particular response (here, teacher assessment and data-based decision making) in the presence of a distinctive stimulus (interacting with student data through *IGDI-APEL*) is similar to Newton's second law, in which a body in motion tends to stay in motion (Mace et al., 1990; Nevin

& Grace, 2000). Applied here, behavioral momentum describes the ways in which teachers who have data at their fingertips in an easy to use format (e.g. *IGDI-APEL)* will remain engaged in data-based decision-making because of the fluid interaction between student, data retrieval, and presentation. Further, behavioral momentum also suggests that if the interaction between the teacher and data remains reinforcing, the response rate will improve such that a cyclical pattern of data-based decision making will become automatic and resistant to change (Nevin & Grace, 2000; Podlesnik & Shahan, 2009). *IGDI-APEL* will accelerate this effect by providing real-time access to child assessment data, highlighting the relation between assessment and data-based decision making (Mace et al., 1990). With *IGDI-APEL* teachers will engage in a process where they assess students because they are seeking data to make instructional changes, not because they are simply required to assess. In turn, those data will reinforce the utility of data-based decision making, yielding improved student outcomes.

Mechanisms of change associated with behavioral momentum and increased self-efficacy will interact reciprocally to build and sustain teachers' use of *IGDI-APEL.* Early applications will provide access to high-quality information that teachers value and can use to positive effect. These short-term changes will lead to apparent and immediate changes in data-based decision making and instruction – changes the teacher will accurately attribute to their own effort. *IGDI-APEL*'s ease of use, paired with this immediate and valued effect will prompt the teacher to persevere in application, deepening and strengthening their use of the intervention as time goes on.

Distal Support: Child Learning and Success. At the distal level, student behavior is viewed within the context of Vygotsky's ZPD (1978; Kozulin, Gindis, Ageyev & Miller, 2003). If the ZPD recognizes the interaction or distance between instruction and a student's readiness for the materials, such that the student will best engage in materials that are at his or her level of development, then *IGDI-APEL* will directly manifest each student's ZPD through the IGDI 2.0 measures. Using CAT technology, *IGDI-APEL* will provide items at each student's individual level, supplying an optimal match between the material each child receives and their actual ability to respond. This match will provide the most robust and meaningful data to teachers to inform instruction.

In sum, our theory of change posits that proximal outcomes for teachers, as measured through surveys of self-efficacy, engagement, frequency and access to the *IGDI-APEL* interface (through automatic recording of interactions with the application), latency between interaction with the data and implementation of evidence-based interventions and assessments of data-based decision making behaviors (see *measures* for more information) will improve through interactions with *IGDI-APEL.* These positive outcomes will impact our more distal student outcome: score on the IGDI 2.0 measures. As a result, we hypothesize that changes in teacher behavior when making data-based decisions will improve instruction and intervention, which in turn will improve student early literacy outcomes.