Introduction: Over the past 15-20 years, researchers have made progress in understanding the effect of Down syndrome on development. The old view was that Down syndrome caused equal delay across all areas of development. We now know that this is not true. Research has identified a specific pattern of cognitive and behavioral features that are observed in children with Down syndrome that differs from that seen in typically developing children and children with other causes of intellectual disability. This pattern of characteristic strengths and weaknesses is referred to as a developmental profile. We are also learning that there is a huge capacity to positively or negatively impact development through intervention. (Sue Buckley, http://www.dseinternational.org/en-us/about-down-syndrome/development/).

Baseline for Profile: The baseline for this developmental profile is “non-verbal mental age.” The term “mental age” refers to an intelligence test score expressed as the chronological age for which a given level of performance is average or typical. “Non-verbal mental age” refers to test scores on practical tasks which do not require language skills – such as completing puzzles or copying block designs or patterns (http://www.down-syndrome.org/information/memory/overview/?page=3). Strengths in the profile refer to scores better than expected for a child’s non-verbal mental age. Weaknesses are scores less than expected for a child’s non-verbal mental age.

Strengths:
Social Understanding, Empathy, Social Skills
Social understanding and interactive skills are a relative strength for children with Down syndrome. Most children with Down syndrome make eye-contact, smile and interact by cooing and babbling from the first months of life and show little delay in social interactive skills. They are socially sensitive and understand the non-verbal cues of emotions, such as facial expression, tones of voice, and body
postures from the first year of life. By school age, most children continue to show good empathy and good understanding of social behaviors, but they will not usually have the spoken language abilities to explain how they feel or to negotiate social situations. Additionally, they also pick up on non-verbal emotional cues, such as anxiety or disapproval, very quickly. They are sensitive to failure and may use behavioral strategies to avoid difficult tasks.

Self-Help and Daily Living Skills
Self-help and daily living skills are listed as a strength. For young children, these skills are often delayed because many activities such as getting dressed and self-feeding depend on solid fine motor skills. Over time, however, most teens and adults are competent with self-help and daily living skills.

Visual Short-Term Memory and Visual Processing
Visual short-term memory and visual processing are relative strengths for children with Down syndrome. This means that children with Down syndrome may be thought of as visual learners and teaching should be supported with visual materials.

Reading
Reading is often a strength for children with Down syndrome, with many children reading better than would be expected for their level of language and non-verbal skills. Children as young as two years old can benefit from reading activities used to teach spoken language. Recent research has shown that reading activities may be the most effective way to improve the spoken language of children with Down syndrome, as well as improve grammar, cognition, and memory.

Neither Strength nor Weakness:
Motor Skills
After about 4 months, typical children are beginning to get control over bodies, holding their heads up, sitting, rolling, crawling and walking. For children with Down syndrome, motor skills are usually delayed for mental age (motor skills are related to mental age because they are “brain driven” – they rely on learning motor plans over time, then require fast online processing when being executed). There is not a great deal of research on motor skill development, but what there is shows a lot of variability. According to an Australian study, higher mental age results in better motor skills, but caution is recommended in drawing firm conclusions since motor skills are also influenced by opportunities to learn and practice. Sue Buckley comments that we see early walkers and late talkers and late walkers and early talkers, so we cannot assume that slow walking means slower mental development.

Note: Children with Down syndrome generally achieve the main motor skill milestones and most children become mobile and independent in self-help skills (feeding and dressing). DSEI also points out that for most children, practicing motor skills will be very important, that occupational therapist sessions may be very beneficial in helping with fine motor skills and that participating in community activities and sports will contribute to motor skill development.

Information Processing
In children with Down syndrome, information processing seems more delayed than the child’s non-verbal understanding and reasoning abilities would indicate. This may be a result of speech and language weakness or working memory deficits.
Weaknesses:

Hearing and Vision
Hearing and vision weaknesses may explain some of this profile. Up to 80% of toddlers and preschoolers with Down syndrome have some level of hearing loss (much of it conductive and improves over time). Hearing loss likely impacts the ability to talk. As described by Sue Buckley, if you have hearing loss which causes even a 30-40 decibel decrease, consonants may disappear. Failing to hear language fully and accurately makes “cracking the code” difficult and holds back language development.

Vision also a factor in development. Many children with Down syndrome need glasses. Vision weakness may also contribute to delayed language development. As Sue Buckley says, “if a child is very short sighted and his mom says ‘Look at the dog’ and he can’t see across the road, it will impact learning to talk.”

Speech and Language
In typical development, language learning is so powerful that by the time a child is 2 to 3 years old, they are using their communication to engage socially. This is not so for children with Down syndrome. Spoken language use is not likely to occur for most children with Down syndrome at such a young age (though some do have spoken words emerging and signing may be used quite extensively by some 2 to 3 year olds to communicate). What you are more likely to see is good basic social understanding, strong ability to pick up on non-verbal cues, but weakness in using spoken language skills to communicate and to learn more about interactions.

For children with Down syndrome there appears to be a pattern of specific language impairment. Most children will understand more language than they can use as a result of specific speech production difficulties. For this reason, many children benefit from learning to sign to communicate, to show understanding and to reduce frustration.

Impact of Language Delay: For most children with Down syndrome, the most serious delay they experience is in learning to talk. This is not only frustrating but has serious consequences for all other aspects of their social and cognitive development. As children learn to talk, each new word that they learn is a new concept or piece of information about their world. Once they can string words together, speech becomes a powerful tool for learning and for communicating with everyone in their world. It also becomes a tool for the mental activities of thinking, remembering and reasoning, which we carry out using silent speech in our minds. While we can also use visual imagery to imagine and recall events, reasoning with the use of language is considerably more powerful. It follows that a serious delay in learning to understand and to use language will lead to delay in all aspects of mental or cognitive development. Conversely, if we can improve the rate at which children learn language, this should benefit all areas of their social and cognitive development.

Verbal Short-Term Memory
Verbal short-term memory seems to be specifically impaired in children with Down syndrome. This weakness may have many consequences. It may result in speech characterized by short utterance lengths, immature syntax, limited range of vocabulary, difficulty storing and processing sentences, and weaker reading and math skills.
Math
Learning math seems to be relatively more difficult for children with Down syndrome than learning to read, but students still make math progress. Research shows that early number skills keep up with non-verbal mental abilities. Sue Buckley suggests continuing with math instruction and using visual supports and materials such as Numicon. Research also cautions against using any math tool away from which it may be difficult to generalize. In the Orange County Learning Program, we have seen a rather large number of students having difficulty generalizing away from Touch Math, which is still used in some classrooms for typical learners.

Implications for Intervention and Education
1. Get regular hearing and vision checks.
2. Address working memory difficulties with sound and word discrimination games from infancy, improving spoken memory development and playing memory games.
3. Encourage motor development at all times.
4. Use social/emotional strengths. Build on emotional responsiveness – encourage social communication (looking, smiling, gestures).
5. Talk and play naturally with children.
6. Always encourage AGE appropriate behavior – do not “baby” or “spoil” a child.
7. Have clear expectations and boundaries.
8. Start appropriate reading instruction for language development early (2 to 3 years).
9. Remember that learning from listening will be difficult but learning from looking will be easier. Always use visual supports (signs, pictures, reading, computer).
10. Enable understanding to be demonstrated without the need for words (choosing, pointing, selecting).

Recognition:
Information above is from the Down Syndrome Issues and Information Guide, An Overview of the Development of Children with Down syndrome (5-11 years) and various seminars on the developmental profile by Sue Buckley.