https://doi.org/10.36315/2022inpact014
Psychological Applications and Trends 2022

EDUCATIONAL ADVANCES ACROSS ALL LANGUAGE DOMAINS: RESULTS AND EXTENSIONS FROM THE DYNAMIC TRICKY MIX MODEL

Keith E. Nelson
Department of Psychology, Penn State University (USA)

Abstract

This paper demonstrates how Dynamic Systems Theory (DST) can generate powerful educational interventions. Our multiple well-controlled studies include typically-developing children between 2 and 8 years of age as well as children with variations of language disorders and with ages between 4 and 12 years. Despite the wide variation in participant characteristics, we argue that our results demonstrate again and again a core conclusion: Rapid progress in language, literacy, and narrative skills only occurs when there is a favorable dynamic convergence of cognitive readiness, scaffolding partner strategies, positive emotional engagement by child and by partner, high attention, and freedom from distraction or anxiety. We term such favorable dynamic convergences Dynamic Tricky Mixes. Under such Dynamic Tricky Mix conditions children displayed significant advances in literacy, oral language, narrative, and sign language. Other labs have shown similar advances for second language learning. Moreover, and quite surprising, under rigorous equation of Learning Condition Mixes during intervention, children with prior histories of very poor learning learned at rates matching that of children with *no* prior learning disabilities. This result held for deaf, autistic, dyslexic, and language-delayed children. These excellent learning rates by the children with severe learning disabilities will aid in planning more ambitious reforms in the language-and literacy-facilitating procedures of educators, special educators, and speech language pathologists. In addition, across all educational domains Dynamic Tricky Mix strategies are powerful catalysts for moving any child from a "stuck" position toward truly rapid learning. We draw further implications from our rapid vocabulary acquisition intervention work with ordinary 4-year-olds. In this case we demonstrated that with twice-weekly sessions vocabulary growth across 5 months leaped forward compared with matched control children. Many children learned at the astonishing rate of 20 new lexical items per hour. By the use of pretest/posttest comparison data on cognitive processes we further demonstrate that the experimentally-caused leap in vocabulary had cascading effects on improved memory and related cognitive skills. Thus, rapid gains by the intervention children dynamically fed into their becoming better prepared for further rapid gains in language acquisition. In turn, this set of findings enriches accounts at the theoretical level of how so much language learning usually can be achieved in the preschool years. Likewise, in evolutionary terms these kinds of mutual enhancements between language progress and cognitive processing power may help elucidate periods when there are explosive rates of changes in *Hominin* cultures and in brain size and capacity.

Keywords: *Children's language advances, dynamic systems, educational interventions, language.*

1. Introduction

Dynamic Tricky Mix theory generated a rich set of empirical studies on advancing children's skills. That research is organized below by the targeted language skills for particular domains. Then our Conclusions section integrates across studies and extrapolates into possible powerful future projects/interventions to aid children's learning.

2. Children's joint advances in literacy and oral language

If we look to create new learning episodes that reflect insights from Dynamic Systems, there are clues from surprising gains made by school-age children with Autism Spectrum Disorder. In the studies briefly reviewed here the children were Swedish children who objectively had a history of slow to zero rates of gain over many preschool and early grade years in two communication modes—speech and text.

Fundamentally new Mixes were created in which the individual child again and again took the lead in using computer software to create messages. By selecting on-screen from text words, the child made text sentences and then the computer displayed sentence meaning through both visual animations and oral Swedish. In these new mixes the teacher's role shifted toward more close observation of the child's interests and communication, along with timely responsive recasts of what the child created along with emotional and social positivity. The children's monthly rates of gain in literacy accelerated over baseline (control) rates by more than 5 times. In Swedish speech, the children also made strong gains. The bottom line for these children with Autism Spectrum Disorder is that after years of extremely slow progress, when new Dynamic Mixes differed dramatically from what children were already receiving, their high potential for progressing at normative rates in both literacy and spoken language was demonstrated (Nelson, 2022; Nelson, Welsh, Camarata, Heimann, & Tjus, 1997).

3. Syntax intervention

In my lab, and in collaborative efforts with multiple other universities, we have often studied children who are about six years of age but whose language levels are delayed by three years—they are talking like typical three-year-old's. The first simplified conclusion that guided most earlier attempts to help these children is that they need special simplistic, didactic input. In language therapy, they were usually given imitation drills that are designed to be repetitive and make obvious to these "slow learners" that sentences have grammatical structure. So, for example, a child might try to imitate twenty sentences in a row that all call attention to -ed and the past tense. The dogs played with the bones. The girls talked on their phones. The boys walked across the grass. And so on.

A second simplifying assumption is that children who have been slow in learning language need their input to be only very slightly challenging. Therefore, the above imitation drill procedures focus only on structures that the child has already begun to use. Past tense examples in a treatment drill would be considered appropriate for any child who—in ordinary conversations—used played, opened, etc. but only 5% to 30% of the times where past tense would always be used by adults.

Surprise! When my colleague Stephen Camarata and I, along with talented graduate students, did a total re-mix of treatment procedures, plus appropriate experimental controls, we found that all of the above assumptions were wrong. Our research was supported by the National Institutes of Health. Moreover, the results of our series of causal experiments have been confirmed in new experiments by independent colleagues all over the globe.

One key to our research was that we knew ordinary conversations vary tremendously. So we borrowed clues from the richest and most challenging examples that we found parents using. We innovated by making rigorous procedures with three different kinds of experimental controls which looked promising for rich conversations. We theorized from Dynamic Systems thinking that re-mixed conversations would trigger rapid syntax/grammar growth by providing high challenges, high supportive conditions, and deep engagement by a child.

And that's exactly what we found! Children with poor histories of language progress now learned rapidly. These children were not learning from their ordinary environments, and even though they were two or three years behind, they Soared in language levels because of the new intervention. We labeled this new approach conversational recasting (Nelson, 2000, 2022; Nelson & Camarata, 1996).

4. Children's vocabulary growth

In one important controlled intervention study two groups of ten 4-year-olds were matched on vocabulary knowledge, awareness of print concepts, working memory, phonological awareness, attention, and ability to generalize. A control group experienced usual play conditions. The second group of children participated in a 12-week word-learning intervention where they were exposed to 450 unfamiliar animal names. In accordance with Dynamic Tricky Mix theory children were exposed to these new words under highly engaging, child-directed sessions in which the investigator followed the lead of the child by allowing the child to dictate the next animal to be learned and by building into playful discussions at least eight tokens of each the new lexical items. This scenario translated into a Mix we would expect to create high rates of learning. Launching conditions included children's interest in the material and the goal learning was presented within the context of free play that they child directed, Enhancers such as numerous and varied visual and verbal tokens of the to-be-learned items were provided. Further, children were rewarded with praise for remembering the animal names, and were never provided with discouraging remarks if they did not, providing opportunity for increasingly positive Adjustments, Children's Readiness for the material was determined through the use of multiple cognitive assessments prior to the intervention. Finally, children's growing knowledge was assessed regularly through tailored interactions in order to gauge children's Network conditions.

Results from the intervention portion of the experiment showed that when children were taught new lexical items during these intensive, rich, positive, and highly engaging episodes they showed exceptionally high rates of gain of up to 20 words per hour. That such a high rate of acquisition can occur suggests children certainly have the capability to learn many new words when the conditions for learning are favorable. In addition, it appears that multiple cognitive gains contributed to these findings. Because we assessed cognitive ability in the two groups of children prior to the intervention, halfway through the intervention, and at the end of the intervention, we were able to compare changes in working memory, phonological awareness, attention, and generalization abilities for children who did and did not participate in the intervention. While children in both groups were well matched on these cognitive abilities prior to the intervention, we saw significant cognitive gains across time only for children in the intervention group (Nelson, 2022; Nelson & Arkenberg, 2008). Thus, rapid gains by the intervention children dynamically fed into their becoming better prepared for further rapid gains in language acquisition because of their newly enhanced cognitive processes.

Highly controlled experimental procedures with human infants and toddlers are of special importance to the conclusions about early symbols and their precursors in behavioural evolution. These procedures reveal whether the infants and toddlers have the capability despite brain immaturity to acquire symbols when given limited, specific sets of learning opportunities. When particular studies have used totally invented concepts (e.g. Blicket, Fiffin, Bloop, Bandock, Weedle) with records of all contexts/durations of exposure to concepts and their symbolic labels, if a child does learn symbol production and comprehension then the entire experiential base for that learning is well documented. Surprisingly, many children by 15 mos. or before are able to learn a new concept from a single labelled exemplar (object, picture) in an episode lasting just 5-to-15 minutes and then able to show knowledge of the concept and its symbolic label when a second or third example is presented for the very first time many days later. Accordingly, children as young as 15 mos. of age are able from a single brief occasion to abstract the characteristics of a concept along with its spoken lexical name, carry this information in long-term memory across 4 days to 2 weeks, and then appropriately apply the vocabulary item to other, newly-encountered examples (Nelson, 1982, 2022; Nelson et al., 2004).

5. Children's narrative learning

According to our review of the literature and our detailed stage account of narrative development, it is evident that for children at 3 to 6 years of age we should expect that very few children will have learned to produce or comprehend narratives of high complexity. This holds true for most children in different cultures studied thus far.

Yet, at the same time we must consider the possibility that if children were given dramatically different learning opportunities in the preschool period most children would be able to handle fairly high-complexity narratives. Our dynamic-systems stage account provides many clues to how newly-effective mixes of learning conditions could be arranged for narrative.

When our lab pioneered such Dynamic-Tricky-Mix causative intervention studies we indeed found that focused dialogues with 3-to-6-year-olds created rapid advances in their narrative complexity. Similar to our findings in other language domains, what was required was a dynamic combination of very high challenge, fun, engagement, and emotional positivity (Nelson & Khan, 2019). This basic outcome on how narrative skills can be accelerated has been replicated and extended by multiple other researchers as well.

6. Conclusions

Overall, we find very parallel conclusions about language learning by typical children and by a variety of children in special education or with preschool language delays. In all studies where we have provided rigorous and controlled intervention procedures which combine high language challenges with multiple enhancing, engaging properties, quite remarkable jumps forward in language skills occurred. Because we involved the children in learning contexts that were far richer dynamically than their usual home or classroom interactions, the children deeply focused their learning mechanisms on language skills they had not yet acquired.

A broader conclusion is that as teachers, researchers, clinicians, and parents, it is not uncommon to underestimate a child's learning potential. So, it wise, and both practical and ethical, to find ways for each child to explore new and especially rich learning contexts which allow an empirical determination of whether a child is prepared cognitively to demonstrate far more rapid learning rates than they have so far shown us (Clarke, Soto, & Nelson, 2017, Nelson, 2022; Nelson & Welsh, 2011; Nelson et al., 2004).

References

Clarke, M. T., Gloria Soto, G. & Nelson, K. (2017). Language learning, recasts, and interaction involving AAC: background and potential for intervention, Augmentative and Alternative Communication, DOI: 10.1080/07434618.2016.1278130 URL: http://dx.doi.org/10.1080/07434618.2016.1278130

Nelson, K.E. (1989). Strategies for first language teaching. In M. Rice & R. Schiefelbusch (Eds.), *The teachability of language.* Baltimore: Brookes.

Nelson, K.E. (2000). Methods for stimulating and measuring lexical and syntactic advances: Why Fiffins and lobsters can tag along with other recast friends. In L. Menn & N.B. Ratner (Eds.), Methods for studying language production (pp. 115–148). Hillsdale, NJ: Erlbaum.

Nelson, K.E. (2022). *Breakthroughs: Realizing Our Potentials Through Dynamic Tricky Mixes*. New York, NY: Morgan James Publishing.

Nelson, K. E. & Arkenberg, M. E. (2008). Language and reading development reflect dynamic mixes of learning conditions. In M. Moody & E. R. Silliman (Eds.). *Brain, Behavior, and Learning in Language and Reading Disorders.* New York: The Guilford Press.

Nelson, K.E., Camarata, S.M., & Camarata, M. (1996). Effects of imitative and conversational recasting treatment on the acquisition of grammar in children with specific language impairment and younger language normal children. Journal of Speech, Language, and Hearing Research, *39*, 850–859. doi:10.1044/jshr.3904.850

Nelson, K. E., Craven, P. L., Xuan, Y., & Arkenberg, M. (2004). Acquiring art, spoken language, sign language, text, and other symbolic systems: Developmental and evolutionary observations from a dynamic systems perspective. In J. M. Lucariello, J. A. Hudson, R. Fivush, & P. J. Bauer (Eds.), *The Development of the Mediated Mind:Sociocultural Context and Cognitive Development,* (pp. 175-222). Mahwah, NJ: Lawrence Erlbaum Associates.

Nelson, K.E. & Khan, K.S. (2019). New frontiers in facilitating narrative skills in children and adolescents: A dynamic systems account. In E. Veneziano & A. Nicolopoulou (Eds.) *Narrative, literacy and other skills: Studies in intervention* (Vol. 25), pp. 173-200. John Benjamins Publishing Company.

Nelson, K. E.., Welsh, J. A., Vance Trup, E. M., & Greenberg, M. T. (2011). Language delays of impoverished preshool children in relation to early academic and emotion recognition skills. *First Language*, 31, 164-194.