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Article

Mindbrain and play–literacy connections

Kathleen A. Roskos
John Carroll University, USA

James F. Christie
Arizona State University, USA

Abstract
Research on the relationship between play and early literacy flourished in the 1990s but slowed to a trickle at the start of the new millennium. As we see it, play–literacy research is stuck in a theoretical and methodological rut. Two promising conceptual frameworks – connectionist and dynamic systems theories – can supply the thrust needed to get this important area of research moving forward again. We give examples of how Fischer’s dynamic skill theory provides analytic tools for examining data on play and literacy, including partially ordered scaling of items (POSI), dynamic modeling, and dynamic assessment. These new tools and theoretical lenses have the potential to answer the essential question: Does play make a difference in early literacy development?

Keywords
preschool play, sociodramatic play, play–literacy connections, play–literacy research, connectionist theory, dynamic systems theory

Introduction

Fortune favors the prepared mind. – Louis Pasteur

In 1974, Wolfgang first published research hypothesizing a relationship between play and reading. The ‘hook’, he argued, was the use of signifiers necessary to both symbolic play and reading. In play, children imbue toys with meaning, just as they must do with print when reading written words.

Corresponding author:
Kathleen Roskos, Education and Allied Studies, John Carroll University, 20700 North Park Boulevard, University Heights, OH 44118-4581, USA
Email: roskos@jcu.edu
He found that children who were more skilled at symbolic play were also the more advanced first-grade readers – a connection corroborated about a decade later by Pellegrini (1985) who identified language use in symbolic play as a key variable in play–literacy connections.

Over the next few decades, the search for play–literacy relationships ranged far and wide, guided primarily by the classic theories of Piaget and Vygotsky. Studies of children’s play language (e.g. Williamson and Silvern, 1991) and symbolic thinking (e.g. Shore, 1998), as well as their play surroundings (e.g. Neuman and Roskos, 1993), described multiple intersections between play and early literacy development (see also Yaden et al., 2000). Entering the 21st-Century, however, the flow of basic research on play–literacy connections has slowed to a trickle. Was this decline in basic research due to the school-readiness currents of recent early education policy and the accompanying emphasis on explicit language and literacy instruction in preschool? We think not. While these policy shifts may act as an impediment (Roskos and Christie, 2007b), it is unlikely that they would cause such a drastic slowdown in play–literacy research. Rather, we believe that the line of inquiry is in a rut. In this paper we discuss how this happened and what might be done about it. We briefly overview play’s changing role in preschool education and the state of science in play–literacy research. Then we turn our attention to dynamic theories of development that offer new possibilities for discovery and understanding of play–literacy relationships in the preschool years.

A few clarifying points are needed before we proceed. Play is complex and takes many forms, ranging from unstructured ‘messing around’ to high-level sociodramatic play – and all appear to be important in human development. Our focus (and proposal for new inquiry) is on sociodramatic play, also referred to as mature play (Bodrova and Leong, 2007), because it is the type of play that is most closely linked to emergent literacy. Sociodramatic play is characterized by symbolic representation, imaginative use of language, role-taking, social interaction, and sustained play activity (see also Elkonin, 2005). In addition, our discussion centers on the connections between this advanced type of play and emerging literacy behaviors, limiting the scope of our proposal for new channels of inquiry to these particular relationships in child development.

**Behind the times and losing ground**

Once a central feature of early childhood education, play is currently ‘under siege’ at the preschool level in the USA (Zigler and Bishop-Josef, 2004).
While play still thrives in some private preschool programs in America (e.g. Waldorf schools, preschools with a Reggio orientation) and in some countries (e.g. New Zealand, Norway), it is rapidly disappearing or being marginalized in many state-funded preschools and some Head Start classrooms. The reasons why are not so hard to understand nor intentionally mean spirited. At the top of the list is the fact that preschool education in America, especially in emergent literacy, is changing. Research on children’s rapidly developing brains in the first years of life, coupled with evidence of the impact of early literacy experiences on future reading achievement, highlight the importance of preschool literacy as the cornerstone of school readiness (Shonkoff and Phillips, 2000). These precious early years lay the foundational skills of oral language, vocabulary, phonological awareness, alphabet knowledge, and print awareness that set the pace for learning to read and write. Small cracks in this foundation can lead to profound consequences for individual children (Snow et al., 1998). By age three, for example, children already show large differences in vocabulary that persist through high school and perpetuate ever-widening achievement gaps (Hart and Risley, 2003; Stanovich, 1986). Clearly, preschool education needs to be better, stronger, and longer to ensure a good foundation for a lifetime of learning (Center on the Developing Child, 2008). To do less puts too many children at risk. In reality, however, this translates into more time devoted to literacy instruction, which means less time for play activity in the preschool setting. Time is a finite resource, and there is only so much of it in the child’s waking hours. When the demand for instruction increases, the time available for free play is obviously reduced.

Play in preschool (as we knew it) is also disappearing in certain preschools for wider societal reasons in an increasingly technological world, making its role in early learning less certain than before. Growing up ‘digital’, today’s preschoolers spend their days surrounded by computers, televisions, MP3 players, cell phones, DVDs, and digital video recorders. A recent article in Pediatrics, for example, reports that 75% of young children, aged birth to six, watch about 80 minutes of television per day. In addition, about 25% of five-to-six-year-olds use a computer for up to 50 minutes a day, and many young children have televisions in their own rooms, even 20% of children up to age two (Vanderwater et al., 2007). What this new digital world holds for young children’s play experience and development is only now emerging. Some evidence from book-based television programs (e.g. Arthur) and eBook studies shows the benefits of playful interactions with stories and print for comprehension and vocabulary learning (De Jong and Bus, 2002, 2003; Uchikoshi, 2005). But the influence of these virtual playgrounds on children’s play skills and
processes remains to be seen, and what such influences might imply for the future design of play environments at preschool can only be imagined.

The 21st-Century idea of virtual playgrounds is particularly relevant to preschool education because new digital technologies are quickly changing what it means to be literate. Once considered singularly language-based, literacy is increasingly seen as multimodal in nature, with children drawing on bodily, visual, aural, material, and technological resources, as well as on language in constructing print knowledge (Hassett, 2006; Kress, 2003). Traditionally linear, static, and sequential, digital texts are combinations of sound, print, and images (Lankshear and Knobel, 2003). As such, they demand a new kind of reader – one who locates, searches, clicks, and scrolls; who simultaneously processes print, graphics, and images; who actively plays with non-linear, multi-layered, non-sequential text forms; and who negotiates multiple perspectives (Hassett, 2006). Becoming literate in an online world, in sum, involves multiple modes of meaning making with a resource mix of sound, image, and print (Kress, 2003). This raises an important but disquieting question. Even if preserved, can traditional preschool play contribute to the development of the new basic skills needed for reading and writing digital texts?

Play at preschool is also losing ground because the science of play study has not kept pace with advances in developmental science. Most play–literacy research, for example, remains loyal to the classical theories of Piaget and Vygotsky, even though cognitive science has moved on to new multidisciplinary, dynamic perspectives (Bransford et al., 2000). Researchers are also using outdated data collection and analysis procedures. Challenging the status quo in the play–literacy field, Pellegrini and Van Ryzin (2007) argue that the use of ‘modern techniques, such as SEM [structural equation modeling] and HLM [hierarchical linear modeling], could be enormously helpful’ for teasing out play–literacy relationships that ‘serve as a firmer basis for educational policymaking’ (pp. 77; 73). While the strong voices of play scholars advocate vigorously for play (Singer et al., 2006), their efforts are hampered by the lack of strong science in play study (Christie and Roskos, 2006).

Our discussion so far provides several reasons why play is in peril at preschool and offers some insights about how and why this may be happening. We see these dangers, but our deeper worry is what we cannot see – the consequences of less play in the preschool developmental period, particularly for literacy growth. If Vygotsky (1966, p. 17) is right – that ‘play bears little resemblance to what it leads to, and only a profound analysis makes it possible to determine its course of movement and its role in the preschooler’s
development’ – then short-changing play during this developmental time might be a serious mistake. Too much instruction and too little play in the early years may lead to qualitative differences in outcomes that are not worth the price. A profound analysis is needed before we let play disappear to our possible regret. For this to happen, we need stronger research designs capable of studying the child at play in context, better analytic tools equipped to probe behavioral complexities, and a greater consilience or unity of knowledge organized so as to make visible what we have not yet learned to see.

**Catching up and changing course**

Late in the 20th-Century, dynamic systems emerged as a growing movement in developmental psychology enlightened by dynamic systems theory in physics, mathematics, and biology (Capra, 2002). The taproot of dynamic systems theory in the physical sciences is thermodynamics, or the science of energy movement, which describes energy transfer and impetus. In thermodynamics, interactions between a system and its surroundings are examined to determine conditions of change. In the developmental sciences, dynamic systems ideas are formulated in connectionist and dynamic systems theories that draw on thermodynamic principles to study growth and change in the mental and physical states of persons. Over the last two decades, both of these theoretical frameworks have had a major impact on the understanding of human development. While considerable debate surrounds whether connectionism and dynamic systems are distinct theories or two sides of one Grand Theory of Development (Spencer and Thelen, 2003), we sidestep this issue for now and highlight instead the central tenets they share as the starting points for new directions in play–literacy research.

Both connectionism and dynamic systems theories take the position that cognitive development is not linear and stable, progressing ‘up’ ladder-like through distinct stages with predetermined start and end points (Fischer et al., 2007). Rather, development is emergent and web-like, following general principles of self-organization that apply to all natural systems (Lewis, 2000). Novel, more complex behavioral forms emerge from the interaction of simpler ones. At points across the sweep of development, these new behaviors coalesce into tightly organized nodes that resemble stages. In this respect, both theories build on Piaget’s constructivist account of cognitive development ‘whereby children act on the world (assimilation) and then adjust their action schemata in accordance with their degree of success or failure (accommodation)’ (Thelen and Bates, 2003, p. 387).
The theories share an empiricist view of environment as a primary source of structure providing external information via interaction processes and environmental affordances (Gibson, 1979). Changes in the external surround may result in different developmental end points. Yet, to be clear, the end points are not predetermined in the environment. Behaviors arise from ‘diverse, heterogeneous, mobile and dynamic local effects’ that structure development – even the hidden layers of internal representations (Munakata and McClellan, 2003; Thelen and Smith, 1994, p. xviii). External sources include social interactions as a source of structure in cognitive development as argued by Vygotsky, although social factors have received less emphasis in both theoretical frameworks as influential shapers of mental/behavioral development.

Connectionist and dynamic systems theories both seek to explain why a behavior changes over time as key to understanding the behavior itself, even as their respective foci on this complex problem differ. Connectionist models focus on underlying neural mechanisms of behavior that produce internal representations, or networks of activity, which constitute performance in cognitive and linguistic tasks. Considerable progress, for example, has been made in understanding children’s early word learning using connectionist modeling (see e.g. Samuelson and Smith, 1999.) Dynamic systems approaches focus on motor behavior and development, providing a detailed picture of behavior at the level at which behavioral patterns arise. Studies of infant walking, for instance, demonstrate the self-organizing nature of skill development (Thelen and Smith, 1994). New action (e.g. stepping) is a change in form (or neural state) assembled to do tasks, not an unfolding of knowledge and structures that are already internally present. In this respect, dynamic systems theory embodies behavior in context, taking the body into account as a source of explanation for understanding cognition.

A final point of agreement between the two theories, and one especially relevant to our purpose, is the central role of mathematical and computer-simulated formalisms in research work. Rooted in thermodynamics, both theories necessitate input from mathematicians in describing the non-linear dynamics and emergent properties of change, as well as the development of models to simulate learning. Activation dynamics, as well as learning rules, for example, are formalized in differential equations that indicate the dynamic nature of change and learning processes. Modeling is used to explore non-linear developmental trajectories in concept formation, critical periods in early language acquisition (e.g. bilingualism), and developmental disorders in word reading. Granted, most play–literacy researchers are not mathematicians nor are they skilled computer-simulation designers. Yet working in close
collaboration with mathematicians, they can productively use the new methodologies and tools of connectionist and dynamic systems theories for the kind of profound analysis that Piaget strived for and Vygotsky envisioned, but for which each lacked the mathematical tools at the time.

Pursuing the road less taken
Thrust, as in to push, is our goal in this article. Play–literacy research, we are arguing, needs a push in a new, dynamic direction. And we propose that 21st-Century developmental theory provides that thrust in two promising conceptual frameworks: connectionist and dynamic systems theories. Both theories drive us to re-think the foundations of play–literacy connections, taking into account from the start the multimodal nature of early literacy and the dynamics of play in the preschool developmental period. Central to both approaches is the notion of emergence of higher cognitive functioning from lower forms, either through instabilities introduced into systems (dynamic systems theory) or via system–environment interactions (connectionism). The conceptual root of both is thermodynamics – the science of energy transformation and its relation to variables in the environment – which introduces thermodynamic laws into the study of behavior in context. Concerned with changes in mental representations, connectionism has tended to focus on areas of cognitive and linguistic development with close ties to information processing, whereas dynamic systems theory emphasizes bi-directional influences on behavior and has examined sensorimotor development in close alliance with Gibson’s (1969) theory of perceptual learning. More recently, however, dynamic systems theory has begun to build a bridge between action and thought that describes the emergence of representational states from sensorimotor origins (Spencer and Schoner, 2003). This is the mindbrain connection – the union of mind and brain in real and developmental time to produce new behavior (Fischer et al., 2007, p. 102). And it is here – where connectionism and dynamic systems theories converge – that new routes for play–literacy research may be found. We cannot explore all, but instead focus on dynamic skills theory as one new direction rich with possibilities for deepening understanding of play–literacy connections.

Dynamic skill theory
Dynamic skill theory provides a framework for the dynamic analysis of development (Fischer, 1980; Fischer and Bidell, 1998). It includes concepts and
methods for analyzing individual behavior in context. Within this framework, the primary unit of analysis is skill, defined as an individual’s capacity to control elements of behavior, thinking, and feeling in a specific context and on a particular task (Mascolo and Fischer, 1999). Changes in the person-context can result in changes in skill level. Consider the everyday life event of learning to ride a bike. With a combination of personal daring, training wheels, and the balancing hand of the adult, the going is easy. Remove the supports and the going can get rough (and tumble). At their onset, skills are highly specific to context and task, but through dynamic processes of co-ordination involving integration and differentiation, skills build hierarchically toward more complex skill organizations that in turn control a more differentiated range of activities.

Skills, in brief, are the building blocks of development, self-organizing into increasingly more complex states of behavior and thought. What develops, therefore, are individual skills – not inherent stages. High-level pretend play skills (the ability to transform one object into another, enact diverse roles, create imaginary situations), for example, evolve from lower-order skills (including motor skills) through a process of co-ordination and differentiation (Figure 1). As simpler, pretend skills re-organize into new ones, they continue to function as supports for emergent, more complex states of pretend behavior and thought. In the biblical sense, skills beget skills.

Developmental levels that are stage-like result from dynamic growth within and across strands (skill domains) in developmental webs, and reflect a universal scale of human development. All persons respond to the orderly ‘ticking of the biological clock’ toward adulthood (Thelen and Smith, 1994). Skill acquisition, however, is not universal, but highly variable within a developmental range due to person–activity–environment sources of variation. No two individuals acquire skills in the same, orderly way even though all achieve certain developmental milestones (given supportive conditions) on a universal scale walking, for example, and symbolic representation abilities. Individual skill performance also varies between functional levels (without supports) and optimal levels (with supports).

How then do individuals progress to higher developmental levels? From a neuroscience perspective, the mindbrain experiences four tiered universal growth cycles that involve reflex actions, sensorimotor actions, representations, and abstractions. During each large growth cycle, skills re-organize or re-assemble into new, more complex ones with the last re-organization the impetus for the next tier. The onset of the representational growth cycle coincides with the onset of the preschool developmental period at around
the age of two. The starting point for new dynamic analyses of play–literacy relationships is primarily situated within this growth cycle.

**Scientific tools**

Play–literacy research is rooted in the emergent literacy perspective, which took hold in the 1980s, and primarily argued that early literacy learning is a social, constructive process that begins much earlier in life than was previously believed. Starting in infancy, children develop literacy concepts and skills...
through everyday experience with others (e.g., parents reading storybooks at bedtime, siblings pointing out print in the environment) (Ferreiro and Teberosky, 1982; Teale and Sulzby, 1986). That literacy developed earlier than had been thought and in nascent forms (e.g., scribbling) was indeed a profound discovery that opened the door for examining early literacy in the common places of early childhood, such as play.

At the time, the classic theories of Piaget (1962) and Vygotsky (1976, 1978) provided conceptual frameworks for investigating play–literacy relationships. Insights derived from a Piagetian view underscored the value of social pretend play for practicing and consolidating cognitive skills, such as symbolic thinking and print awareness. Vygotskian theory foregrounded the role of adults and peers in helping young children acquire social literacy practices. Even as these frameworks drew considerable attention to play’s potential as an activity setting for literacy practice and engagement, they faltered in proving play’s function in children’s literacy development and learning (Roskos and Christie, 2000; Smith, 2010). The essential question of Does play make a difference in early literacy development? went unanswered. Identifying mechanisms by which literacy-like behaviors unfold in active play, as well as how play competencies exchange with emergent literacy competencies, lacked the scientific tools for the profound analysis required. Dynamic skills theory, however, provides several analytic tools for examining these kinds of developmental data under new lenses.

Ordering developmental webs. A new order-analytic technique called partially ordered scaling of items (POSI) provides a method for capturing point-to-point or time-to-time variations in children’s status or performance (Kuleck and Knight, 1999). It permits the analysis of diversity in developmental pathways following the principle of equifinality: multiple routes to the same developmental destination (Sackett et al., 1981). In a dynamic system, individuals develop along multiple strands to form a developmental web that reflects varying patterns of growth in a skill domain. Assessment, however, has often been insensitive to different routes in development, compressing them into a single scale based on the assumption that there is only one developmental pathway—a stance that obviously underestimates diversity in developmental pathways (Bronfenbrenner, 1993). The POSI technique provides a statistical solution to this problem.

Using the logic of scalogram analysis (Guttmann, 1944), the technique ‘orders performance profiles across tasks to assess not merely a linear sequence or ladder, but a web with branching’ (Fischer et al., 2007, p. 105). In brief, multiple, partially ordered tasks are used to assess a predicted developmental
sequence in a domain toward the goal of analyzing diversity in developmental pathways. Consider, for example, the ‘rough sketch’ of the predicted developmental sequence for early pretense in Figure 1. (See Christie and Johnsen, 1983, for a review of pretend development.) The starting point is de-contextualizing of behavior, thought to evolve along two parallel routes that combine to form more complex pretend skills. This predicted sequence may be tested with a set of well-chosen tasks, albeit partially ordered (that is with branches), to assess individual development in the sequence and also detect differences among children.

How does POSI work in principle? Assessing developmental webs originates in the ordering of skill sequences – a process that depends first and foremost on the integrity of an underlying model of how behaviors progress over time. Robust theoretical models that offer well-defined domains and plausible relationships among variables are necessary for ordering developmental sequences. Once an hypothesized developmental sequence or web is determined, tasks are designed to assess skills both within and across a skill development matrix. Separate tasks assess each step in the sequence, resulting in a profile of the performances across tasks for each individual child. POSI then entails computer-based analyses of a set of profiles to describe hypothesized developmental sequences or webs. The analytic procedure identifies statistically significant orderings in the data by comparing profiles for all pairs of tasks and also estimates the distance between ordered items (Fischer et al., 2007; Kuleck and Knight, 1999). The resulting order analysis dendrogram (graphical tree diagram) shows the ordering of skills based on the significant hierarchical pairings and also a ‘difficulty distance’ between skills. The distance from one skill to another, for example, may be a short hop whereas between others it may be a great leap, which has implications for teaching and learning. The general outcome of POSI analysis confirms, or not, a hypothesized developmental sequence or web, and thus informs the understanding of differences in change, growth, development, progress, or evolution in a specific domain. (See Knight and Fischer, 1992, for a fuller description of the technique.)

Our description of POSI as an analytic tool is necessarily brief yet suggests the potential for examining existing developmental data in cognitive domains shared between play and early literacy, such as narrative competence, oral language comprehension, and symbolic representation. It allows examining relationships among skills and tasks in relevant domains indicative of growth patterns that may foster emergent literacy in young children. It would be intriguing, for instance, to design a set of tasks in the thematic-fantasy play...
paradigm tradition (i.e. role enactment of fairy tales; see Saltz and Johnson, 1974) to analyze growth patterns of play and narrative skill development that overlap with the listening comprehension processes that are foundational in reading comprehension.

Modeling dynamic development. Dynamic modeling, a computer-based simulation formalism, permits a view of the dynamic complexity in systems. A system – weather, economics, cognitive processing – exists and operates in time and space. Models are built and tested to represent systems and to better understand them. Increased access to easy-to-use computer tools, such as Excel or Model Maker, puts dynamic modeling within reach of play–literacy researchers as an analytic resource for building and testing theories, and for examining how well specific developmental data fit a model.

A possible value-added feature of dynamic modeling for play–literacy inquiry is the much-needed rigor it can bring to the field, which has a long history of fuzzy definitions and muddled observational methods (Christie, 1991; Pellegrini and Van Ryzin, 2007; Roskos and Christie, 2000, 2007a; Smith, 2007). To use modeling techniques requires pinning down the often vague definitions of preschool play activity and specifying the ‘rulers’ employed to assess development in ‘cross-walk’ skills between pretend play and early literacy (e.g. symbolic thinking). This, of course, is difficult given the detail complexity of play–literacy systems in preschool children and the bi-directional nature of their joint development. Yet such work is necessary for greater theoretical consistency in views of preschool play, for better definitions of key constructs, and for more rigorous observation methods.

A model of hierarchical skill development that describes how different skills in a domain develop concurrently and influence each other is a good beginning. Consider oral narrative competence, for example, since the domain is relevant to both preschool collaborative pretend play and early literacy. In play research, Eckler and Weininger (1989) observed a structural correspondence between Rumelhart’s story grammar scheme (1977) and pretend play behavior in children aged four to eight, suggesting that skill in storying may influence skill in pretending. Based on developmental data from language research, oral narrative competence shows stage-like growth from simple two-event narratives around the age of three to well-formed stories around the age of six (Peterson and McCabe, 1983). Computer simulations of the logistic growth of specific narrative skills (e.g. sequencing events) in an oral narrative competence model can show how different connections affect competence, including variables such as amount and quality of collaborative pretend play experience. Simulating the model, which represents a theory of change, allows
observations of connections and interactions that would normally unfold over
very lengthy time periods. Simulations, in sum, can illuminate trajectories in
individual skill learning, as well as broader growth patterns in the develop-
mental sequences of a skill domain.

We have yet to encounter dynamic modeling tools applied to play–literacy
research problems, which is not to say that the potential is not there. Rowe’s
(2000, 2007) fairly lengthy studies of book-related dramatic play in two
settings (home and preschool classroom) may contain sufficient developmen-
tal data for model-making, which in turn can lead to model-testing using
dynamic modeling tools in future research.

Dynamic assessment. Another powerful analytic tool is dynamic assessment – an
approach that examines individual competence within a developmental range
(Lidz, 1987). As an alternative to static assessment, which measures what is,
dynamic assessment measures both functional and optimal levels of perfor-
mance. A functional level is the best a child can do without support. The
optimal level is the best he or she can do with high support that primes
performance via cues, prompts, or strategies. Readers may recognize the the-
oretical roots of dynamic assessment in Vygotsky’s concept of the zone of
proximal development, which attempts to explain the variability that occurs
during skill learning (Vygotsky, 1978). It is also noteworthy that Vygotsky
viewed play in the preschool developmental period as a zone of proximal
development, per se, neatly captured in the memorable phrase ‘a head taller
than himself’ as descriptive of the preschooler’s skills in this high-support
context.

In dynamic assessment, well-designed learning tasks are key to identifying
functional and optimal levels of performance. Each includes levels of assistance
that provide support for successful completion of the task. The goal is to
identify the concepts and skills that the child cannot yet use, as well as the
level of assistance required to do so. Consider a name-writing task, for exam-
ple. If the child can write her name from memory, no assistance is provided.
If not, the option of copying from a sample is given. If this support is insuf-
ficient, the option of tracing is provided. And if this is not enough, the adult
hand is placed over the child’s and guides the name writing. What this
approach yields is the child’s developmental range from lower to upper
limits in skill performance. The implications for research and education are
clear: the tool permits more careful observation of variation in development
which increases understanding of growth patterns, and it allows for more
precise information about skill performance which informs ‘tutoring’ and
instruction.
Using the tool of dynamic assessment creates new possibilities for observing play-literacy connections. It, in fact, has the analytic power to re-energize research on literacy-enriched play settings as supportive learning environments for language and literacy development in early childhood. For example, researchers could develop assessment tools that measure pretend play skills, layering literacy-enriched play environments with social supports and observations of individual children at play to document the kinds of ‘assists’ individual children are using to accomplish literacy-related tasks.

For example, one could construct a two-dimensional grid (Table 1) with the rows listing social supports for literacy-enriched dramatic play (e.g. props, print, preparatory experiences, peer talk, and teacher talk) and the columns containing structural aspects of mature play (e.g. roles, routines/scripts, and rules). A row at the bottom could be used to record the current play performance of specific children in each structural aspect of play. We envision this grid being used in several phases:

- **Phase 1**: Document the social supports that are available for each structural aspect of play.
- **Phase 2**: Use with individual children to determine which supports the child is using (these could be checked off or underlined) and record level of the child’s current play performance (roles adopted, scripts acted outs, ability to follow rules).
- **Phase 3**: Information from Phase 2 could then be used to plan an intervention (encouraging child to use an existing support, adding a new support, etc.) to boost their level of performance.
- **Phase 4**: The instrument could be used again to evaluate the effectiveness of the intervention.

Table 1 illustrates how the observation scale might look if used in the mechanic’s garage play setting in a classroom of five- and six-year-olds described in a chapter by Hall (2000). Here the teacher has provided support for the garage play by taking children on a field trip to a neighborhood garage, leading group discussions of the garage roles and the routines associated with those roles, engaging in a variety of theme-related literacy activities (making job ads, filling out job applications, writing list of rules for roles and activities, etc.), supplying several theme-related costumes and props, and so on. If the Phase 2 observation revealed that a specific child had taken on the role of mechanic but did not act out any role-appropriate routines/scripts, an intervention might be planned. This child was taking advantage of some of the
available supports — she went on the field trip, manipulated some of props, put on a mechanic’s cap — however, she did not seem to be attending to theme-related print and did not actively participate in the group discussion of roles and routines. A possible intervention might be to add more support in the Teacher Talk area. The teacher could become a co-player (Roskos and Neuman, 1993), taking on the role of another mechanic and modeling what mechanics do and how they talk. Or perhaps the teacher might want

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**Table 1. Social supports for literacy-enriched dramatic play: A mechanic’s garage**

<table>
<thead>
<tr>
<th>Roles</th>
<th>Routines/Scripts</th>
<th>Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Props</strong></td>
<td>Caps, overalls, gloves, welding masks</td>
<td>Toy and real tools, cardboard hydraulic lift, clipboards, pencils, broken tricycle</td>
</tr>
<tr>
<td><strong>Print</strong></td>
<td>Help wanted ads and job applications for manager, secretary, and mechanic</td>
<td>Tricycle repair estimate, lists of rules for garage activities (e.g. welding), car repair manuals</td>
</tr>
<tr>
<td><strong>Preparatory experiences</strong></td>
<td>Field trip to neighborhood mechanic’s garage — children observed four roles: manager, mechanic, secretary, customer</td>
<td>Field trip — children observed what the people in the four roles were doing</td>
</tr>
<tr>
<td><strong>Peer talk</strong></td>
<td>Participated in group discussions of roles, metaplay talk (‘I’ll be the mechanic and you can be the customer.’)</td>
<td>Participated in group discussions of garage activities and group play planning, metaplay talk (‘Let’s put it on the lift first, then take off the wheel.’)</td>
</tr>
<tr>
<td><strong>Teacher talk</strong></td>
<td>Led group discussion of who did what in the garage and what each job or role involved</td>
<td>Led group discussions of garage activities</td>
</tr>
</tbody>
</table>

**Play performance**

Name:  
Date:  

1Play theme and environment loosely based on Hall, 2000.
to focus on the Preparatory Experience area and read *Sylvia’s Garage* by Debra Lee (Wright Group, 2003) to the class. This book describes what mechanics do and provides a role model of a female mechanic. It lays out a script for the child to follow. After the intervention, the grid could be used again to evaluate which supports the child was now using and the current level of her play.

This approach takes advantage of child-initiated play activity as a framework for carrying out dynamic assessment in the classroom setting over time – and in this respect it is less controlled. A variation on this approach is more explicit, adhering more closely to a dynamic assessment model (Fischer et al., 1993). Assessment occurs in a play context that involves the same setting, props, materials, and procedures: the social support provided by the adult varies in terms of degree and type. The focus of assessment is on a developmental sequence in a specific skill domain, such as narrative competence, make-believe transformations, or early literacy skills (e.g. pretend reading). For example, the goal could be to measure emergent reading skills (Sulzby, 1985), and the play activity might be a bedtime story routine. In conditions of low support, the child is simply asked to *read the baby a story and put the baby to bed*. The child’s functional level is identified in the developmental sequence (e.g. attending to pictures and forming oral stories). In conditions of high support, the adult ‘primes the pump’ for more complex behavior along the developmental sequence, using techniques such as cueing, modeling, and co-playing to identify the child’s optimal level of competence. The interval between the two levels is the child’s developmental range wherein new instruction may be most productive for skill growth.

Both approaches to dynamic assessment, whether situated in child-generated play arising from a play setting with well-designed supports or located in an adult-initiated assessment through assisted play activity, offer new lenses for observing individual performance in context. The analytic tool of dynamic assessment also permits a closer view of play–literacy connections – the developmental junctures where cognitive skills intersect to the mutual benefit of both developmental domains.

**Momentum for a new thrust**

We lobby here for change, arguing that basic play–literacy research is stuck in a theoretical and methodological rut. To continue along its well-worn pathways within familiar paradigms is to repeat the research cycles of the past that largely describe the potential for play–literacy relationships, but do not explain the potential of these relationships in preparing the mindbrain for literacy as a
mental tool. Certainly play–literacy research over the past several decades has shed light on the cognitive links between preschool play and literacy (e.g. narrative competence) and the role of the play environment in shaping emergent literacy behaviors. The direction of this line of inquiry will continue to do so in descriptive ways that add rich detail to the potential in play–literacy relationships. Welsch (2008), for example, recently described book-related pretend play among 33 four-year-olds that reinforced Rowe’s (2000) earlier observations of child-initiated pretend play schemes directly linked to children’s literature. Such research supports and augments, but it does not push into relatively unexplored areas that lead to new understandings and new insights.

To gain momentum for a new thrust in basic play–literacy research, we urge a wider use of connectionism and dynamic systems theories, which build on the shoulders of Piagetian and Vygotskian theoretical frameworks for a better view of literacy at work in play and vice versa. Dynamic systems approaches to play–literacy relationships invite us to explore how mutually reinforcing behaviors and skills, such as pretending and narrating, emerge and combine to create ‘webs of developing skills and activities’ that pull cognitive development forward to new levels (Fischer and Immordino-Yang, 2002, p. 13). From this vantage point, we can study play–literacy connections through a multiple-skills lens, theorizing how play and literacy skills develop simultaneously and interact to form longer developmental trajectories of language and literacy learning. Changing the lens may illuminate new energy nodes of precursor skills (e.g. pretend awareness) that are indeed causal links in emergent literacy. To this purpose we recommend three analytic tools from dynamic skills theory – POSI, dynamic modeling, and dynamic assessment – with the potential to generate clearer and more complex definitions, descriptions, and assessments of play–literacy connections in the preschool developmental period. We realize that these new tools (as with all things new) should be used with caution to avoid a reductionist effect on play, diminishing play’s inherent richness and complexity. Mixed-methods research designs, which combine these new quantitative tools with rich qualitative descriptions of play behavior, offer a promising way to avoid this pitfall.

Before closing, permit us one final point on the advantages of dynamic systems approaches, such as the dynamic skills theory we described here. At the crux of the play–literacy connection is language, an affordance of the environment that is not only a code but also a culturally-based tool for acting and thinking (Gibson, 1969). In social play, children’s language is necessarily multimodal because it is an expression of their whole person and the
context—it is at once vocal, auditory, visual, and gestural. So used, language is a tool of the mind that develops the child’s ability to act intentionally. It presses not only for knowledge of how the self should perform in the situation, but also for self-regulation so that only some affordances are attended to and not others (Reed, 1993). This is the core finding in the Diamond et al. (2008) executive function study, which demonstrated the benefits of mature dramatic play for developing self-regulation skills that support academic tasks (such as learning to read). To explain how language use in play contributes directly to cognitive skills needed for literacy requires more robust theory that goes beyond the limitations of classical theories and that guides analysis of behavior in context as it emerges, i.e. its dynamics. Connectionism and dynamic systems theories—both cut from the same theoretical cloth—offer the flexibility and the foundation for a fresh approach to understanding the origins, shape, direction, and growth of play–literacy interactions that give rise to trajectories of literacy development.

References


