Developing Mathematical Concepts

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Many of our activities with children will later help them learn reading; we read to them; we play games with them, to practice eye-hand coordination; we help them interpret pictures, and picture sequences (cartoon strips); we enrich their experience with things to read about.

Many of our activities with children will later help them learn mathematics, too. The studies of Piaget and others have established that true counting, applied to counting sets of objects, must be abstracted from a rich experience. Two types of activities are especially important for building the experiences from which counting will later be abstracted: matching activities, and ordering activities.

Matching Activities. The following occasions provide opportunities for matching; setting the table: one bowl — one person, one chair — one person; feeding animals a child's sense of "being fair" leads to excellent matching; dressing: one sweater — one child, one foot — one shoe; doll play: e.g. one doll — one place to sleep, one doll — one name; toy car play: e.g. one car — one parking place; matching pictures of mother and baby animals; party favours: e.g. one hat, or balloon, or valentine for each child; sorting laundry, e.g. pairing socks.

Ordering Activities. Repetetive nursery games with words and gestures are a rich source of ordering experiences. The best are those that are personal and friendly and touch a child's toes, fingers, chin, nose. These games teach order, even if they have no counting in them. Examples in English are: "This Little Piggy Went to Market", "Creep, Mouse", "Knock on the Door".

Bounce-on-my-knee games are excellent, because the big bounce at the end leads the child to anticipate, and so involves him in the sequence. Examples in English are: "Trot, Trot to Boston", "This is the Way the Gentlemen Ride", "A Curious Pup".

Many nursery songs, tales and verses have a simple recurring pattern such as verse-and-refrain, circular songs whose end leads back to the beginning ("There's a Hole in My Bucket"), progressive sequences that add one more with each verse and repeat the whole list ("This Is the House That Jack Built", "Old Macdonald Had a Farm").

Other examples of ordering experience, so essential as a basis for numeracy, are turning pages of a book, using stepping stones and staircases, both very important in carrying the inner notions of counting directly to the child's body, singing scales in music or any ordered routine, such as a bedtime or mealtime ritual, which should of course be a participatory experience for the child.

We recognize that our children have not learned to read the first time they memorize a story and "read" the pictures. Still, we encourage this experience, because it will eventually contribute to reading skills. Similarly, in mathematical development, passive experience plays an important part. As we count objects for children while they match the objects, as we read the car milometer, figure mileages on a map, compare prices, tell time, and so on, we are teaching-in-

action. Another excellent activity is to make a growth chart for each child, showing weight or height changes, preferably on a large wall chart. One of the main things we are teaching is correct attitude. We show that we are comfortable with counting, that it seems natural and easy to us, that we expect counting to be useful and easy for the child some day.

Pre-Arithmetic. As pre-schoolers approach five years of age, their experience with pre-arithmetic may become more active and participatory. The following is a list of suggested arithmetical activities: making change with real money or with play money, game chips or pebbles. The use of calendars e.g. counting how many days till a holiday or birthday. It is especially good if each child owns a calendar with large write-in spaces. With help, a child can make a calendar for an important month, such as his birth month.

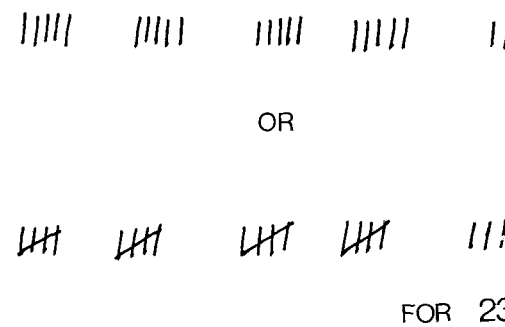
Children's own precious collections are ideal counting practice, as well as practice in "more", "less", "equal". Birthday counting uses the natural interest in numbers at birthday times — how many years, how many candles, how many guests, how many treats. How old was the child last year, how old will he be next year. Number of playmates of the same age, of playmates who must wait till next year to be that age, and so on.

Dealing activities are passing cookies, raisins, carrot-sticks, round and round a circle of friends. These are excellent pre-arithmetic experience, especially necessary for learning multiplication and division years later. If the deal does not "come out even", the child sometimes anticipates fractions by breaking the last cookies.

In outdoor yard games such as running and tagging the structure, or process is important, rather than the counting by 5's. Learning jingles for "counting out" to see who must be "It" are good pre-multiplication games. Playing with blocks and jigsaw puzzles gives experience with geometry and bead stringing gives practice in sequences. Childrens growing perception of pattern and structure can be observed when they first notice such things as that lots of fairy tales start out with three brothers. This is a day of triumph and deserves a prominent place in his book of achivements, for he has done an advanced job of abstraction, and shown real mathematical talent.

Role-playing, through dolls, plays, identifying with story characters, builds practice with analogies, an important and basic idea for mathematics and for all education.

Tallying: long before children learn to draw numerals they can enjoy making tally marks on paper or in dirt, counting passing cars, or birds, or their own collections of objects with marks, preferably in bunches of ten, like this:



Few of the activities listed above are new, though it is helpful to have a check list to ensure inclusion of all types of activities for each child. The surprising thing is the mathematical content of these traditional children's games. As we take delight in our children's early steps, first words and sentences, early letter recognition and reading, we may add a whole new dimension of mathematical enjoyment in watching for early abstraction of story plots, in recognition of the "progressive" pattern of nursery songs, and in fostering growing skills in mathematical competency.

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Si nombre des activités que nous organisons pour les enfants peuvent, plus tard, leur faciliter l'apprentissage de la lecture, nombre d'activités constituent aussi une excellente initiation aux mathématiques. Compter est une opération abstraite, qui doit s'appuyer sur une longue et riche expérience. Deux types d'activités sont particulièrement recommandées pour la constitution de cette expérience: les activités de tri ou appariement et celles de rangement.

Activités de tri ou appariement: Mettre la table: une assiette par personne; donner à manger aux animaux: à chacun sa part; s'habiller—un chandail par enfant; jeu de la poupée; chaque poupée dans son lit; jeu des petites autos: chaque auto dans son garage; animaux et leurs petits; appariement des chaussettes aprés la lessive.

Activités de rangement: Jeux chantés ou mimés, où il faut prononcer des mots, faire des gestes dans un certain ordre, même si les chiffres n'interviennent pas; jeux où l'on touche les orteils, le menton, où l'on fait sauter l'enfant sur les genoux; comptines, contes, chansons à motifs, éléments qui se répètent: strophe et refrain, fin aboutissant au recommencement, énumération reprise en l'allongeant indéfiniment; tourner les pages d'un livre; sauter de pierre en pierre (à travers un ruisseau ou une pelouse), gravir un escalier (très importante initiation au calcul faisant entrer en jeu tout le corps); monter ou descendre la gamme; accomplir la série d'actions qui préludent quotidiennement aux repas ou au coucher.

L'initiation au calcul peut prendre aussi une forme plus passive: entendre les adultes compter des objets, établir le kilométrage d'une randonnée sur une carte, lire la vitesse marquée par le compteur, comparer des prix, donner l'heure, noter sur un graphique la taille ou le poids de l'enfant. Par toutes ces opérations, nous montrons à l'enfant que compter est une opération simple et courante—et d'une utilité quotidienne.

Le pré-calcul. Faire de la monnaie avec des pièces, des jetons, des cailloux; consulter le calendrier; compter les jours séparant l'enfant d'un anniversaire; collectionner (cette activité est excellente pour apprendre à compter, mais aussi pour acquérir les notions de plus, moins, égalité); compter les ans à chaque anniversaire, exploiter l'intérêt que l'enfant porte aux chiffres à cette occasion; distribuer: donner des biscuits, des raisins secs, des olives; jeux de plein air, pour apprendre à l'enfant la structure et le déroulement des jeux; jeux de cubes, jeux de mosaïques, puzzles pour acquérir le sens de la géométrie; enfiler des perles pour apprendre la suite des chiffres; aider les enfants à dégager/expliciter des motifs (reconnaître des parallélismes ou éléments répétitifs dans des contes ou des jeux dénote une aptitude à saisir les abstractions mathématiques); jeux de rôle au moyen de poupées, jeux dramatiques, identification à des personnages de contes pour apprendre à dégager des analogies, aptitude essentielle à l'étude des mathématiques et à tout apprentissage; marquer des quantités au moyen d'encoches (longtemps avant de savoir faire les chiffres, les enfants peuvent prendre plaisir à cocher). Ces diverses activités ne sont pas nouvelles, mais elles peuvent jouer un grand rôle dan l'initiation aux mathématiques.

Asi como muchas de nuestras actividades con niños les servirán más tarde de ayuda para aprender a leer, otras muchas poseen valor pre-matemático. El contar es un proceso abstracto y en consecuencia debe ser abstraido de una experiencia valiosa. Hay dos tipos de actividades especialmente importantes para crear las experiencias de las que más tarde puede abstraerse el acto de contar: actividades de parear y actividades de ordenar.

Actividades de parear. Poner la mesa—un plato, una persona; alimentar animales; vestirse—un jersey, un niño; jugar a las muñecas—una muñeca, una cama; coches de juguete—un coche, un lugar para aparcar; animales niños y sus madres; emparejar calcetines después de su lavado.

Actividades de ordenar. Juegos de jardines maternales con palabras y gestos en un orden definido, aunque no esté implicado en ellos el acto de contar; juegos personales que tocan los dedos del pie del niño, la barbilla; juegos de balancear en la rodilla; canciones infantiles, cuentos y poesías, con modelos familiares: verso y estribillo, canciones circulares (el final se une al principio), series en order progresivo (repetir la lista previa, añadiendo una más cada vez; dar la vuelta a las páginas de un libro: usar piedras que pasan de una a otra y escaleras (preparación muy importante para contar, por medio del propio cuerpo del niño); escalas de canto en música; rutinas ordenadas a la hora de acostarse o de las comidas.

Los niños se benefician también de experiencias pasivas en matemáticas: oir a los adultos contar objetos, leer el cuenta-kilómetros de un coche, calcular las distancias en un mapa, comparar los precios, decir la hora; hacer una tabla con el peso o la estatura del niño; de esta manera les demostramos que contar es un acto familiar y fácil y que esperamos que le sea útil algún dia al niño.

Pre-aritmética. Hacer cambio, con dinero, pedacitos de madera, chinitas; utilizar calendarios; contar cuantos días faltan para un cumpleaños; coleccionar—útil para contar y practicar en "más", "menos", "igual"; contar cumpleaños; haciendo uso de un interés natural en números en esta época; repartos pasar galletas, pasas, bocadillos; juegos al aire libre, en patios, para la estructura o el proceso de los juegos: tacos y piezas de rompecabezas para la geometría, ensartar cuentas para aprender más series; ayudar a los niños a articular su percepción de ciertos modelos; reconocimiento de modelos similares en cuentos o juegos demuestra una habilidad matemática para la abstracción; desempeño de determinados papeles con la ayuda de muñecas, drama, identificación con personajes de cuentos, para el desarrollo de analogías, básico para las matematicas y la instrucción en general; llevar cuentas; bastante antes de que el niño aprenda a dibujar números, se divierte haciendo marcas o señales indicativas de esas cuentas.

Estas actividades son ahora nuevas, pero su contenido matemático puede ser considerable.