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A bioecological Content Analysis: An Analysis Technique Rooted in the Bioecological Model for Human Development

Abstract

A bioecological content analysis is an analysis technique rooted in the bioecological theory of human development and the Process–Person–Context–Time (PPCT) model. In this article, we outline what a bioecological content analysis is and provide guidelines to researchers, students and others who want to use it in large or small scale life story oriented research on such matters as children with special needs and their families, early intervention and early childhood special education. A discussion of advantages and disadvantages of the bioecological content analysis is provided.

Keywords: Bioecological content analysis; Bioecological model for human development; Life story research; Matrix; PPCT-model.

Introduction

Researchers who investigate human development often use Bronfenbrenner's bioecological theory/model for human development as a theoretical, conceptual and analytical frame in their studies. The reason for this is that the theory provides a comprehensive and reasonable explanation of what influences human development, as well as useful concepts that can be adopted in research descriptions and analyses.

The researchers Lundqvist (2016) and Lundqvist, Allodi Westling and Siljehag (2015), for example, took on the bioecological theory as a theoretical, conceptual and analytical frame in a study about special educational needs and support provisions in Swedish preschools. In their multiple-case study, the children's abilities were described (biosystem) and the children with special educational needs were viewed within preschool settings (microsystem settings) and ongoing proximal processes. Connections between home and preschool on such matters as transitions to the next school form were analyzed, as were the allocation of resources from the community (exosystem), the content of national policy document (macrosystem) and changes during early school years regarding support needs and provisions (chronosystem). The researchers Hanson et al. (2001) also took on Bronfenbrenner's theory on human development as a frame in a study about

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multiple influential factors on children's educational placements decision from inclusive preschools to elementary school. In their longitudinal study, the data were collected via interviews and observations of documents and classrooms. The children's characteristics (biosystem) and the characteristics of classrooms, homes and families (microsystem environments) were analysed, as were the interrelationships between microsystem settings (mesosystem), impact of community and school structure (exosystem) and national values and beliefs related to disabilities, inclusion and early education (macrosystem). Changes over time (chronosystem), regarding inclusion placements were also investigated and discussed. Another example is a study by Rimm-Kaufman and Pianta (2000). They analysed educational transitions to Kindergarten. In keeping with the bioecological theory, they recommended not only to look at a child's characteristics in investigations of educational transitions placement in Kindergarten, but also to look at ecological factors. Several more examples of such bioecological framed studies exist; for example, Sandström, Lundqvist and Axelsson (2019) and Axelsson, Lundqvist and Sandström (2017) in which parents of children in preschool and preschool class describe their children, their children's learning environments, their collaboration with staff in these learning environments and their children's transitions from preschool to preschool class via life story research.

A first draft, in Swedish, to the bioecological content analysis and matrix (Lundqvist, Sandström, & Axelsson, 2016) was developed parallel to life story researches (Axelsson, Lundqvist, & Sandström, 2017; Sandström, Lundqvist, & Axelsson, 2019). One of these was built on data from several longer retrospective interviews (N=27) and the other on a few longer retrospective interviews (N=3) which in the studies were referred to as life stories. These studies were based on Bronfenbrenner's bioecological model and acknowledged proximal processes (e.g. educational activities, routines and free play) as engines for human development. Since then, the analysis technique has been somewhat revised: Phases as well as the terms biosystem subcategories, microsystem subcategories, mesosystem subcategories, exosystem subcategories, macrosystem subcategories and chronosystem subcategories have been added.

In this methodologically oriented article, the revised bioecological content analysis is being outlined and discussed. It is rooted in the bioecological model for human development and makes use of its central ideas and concepts. A matrix (Table 1) is attached to the bioecological content analysis, and is therefore also presented in this article. The bioecological content analysis comes in two versions – one for large scale life story studies and one for small scale life story studies. Life story research, which can also be referred to as a life story study, is a research approach that can be adopted by researchers who aim to investigate and deepen the understanding of people's life experiences and their reflections on these experiences (Bertaux, 1981; Goodson & Sikes, 2001; Jepson Wigg, 2015).

The bioecological model and the PPCT-model

The bioecological model for human development (Bronfenbrenner, 1979, 1992, 2001; Bronfenbrenner & Morris, 1998) is a theory about intellectual, social, emotional and moral development. It took Bronfenbrenner several years to elaborate the conception of the bioecological model and during these years he was inspired by well-known scholars, for example Sigmund Freud, Kurt Levin, George Herbert Mead, Jean Piaget and Lev Vygotskij (Bronfenbrenner, 1979); he was assisted by colleagues, for example Pamela Morris, Richard Lerner and William Damon.Two periods, separated by the year 1979, are worth mentioning during the development of the model. In 1979 his landmark volume 'Ecology of human development: Experiments by nature and design', was published. In this book he presents the famous concepts of microsystem, mesosystem, exosystem and macrosystem, and underlines the role of context on the child's intellectual, social, emotional and moral development. Bronfenbrenner (1992) defined these four systems in the following way:

> *A microsystem is a pattern of activities, roles, and interpersonal relations experienced by the developing person in a given face-to-face setting with particular physical and material features and containing other persons with distinctive characteristics of temperament, personality, and systems of belief. (p. 148)*

> *The mesosystem comprises the linkage and processes taking place between two or more settings containing the developing person (e.g., the relations between home and school, school and workplace). In other words, a mesosystem is a system of microsystems. (p. 148)*

> *The exosystem, encompasses the linkage and processes taking place between two or more settings, at least one of which does not ordinarily contain the developing person, but in which events occurs that influence processes within the immediate setting that does contain that person (e.g., for a child, the relation between the home and the parent's workplace; for a parent, the relation between the school and the neighbourhood group). (p. 148)*

> *The macrosystem consists of the overarching pattern of micro-, meso-, and exosystems characteristics of a given culture, subculture, or other broader social context, with particular reference to the developmentally instigative belief systems, resources, hazards, lifestyles, opportunity structures, life course options, and patterns of social interchange that are embedded in each of these systems. The macrosystem may be thought of as a societal blueprint for a particular culture, subculture, or other broader social context. (p. 149-150)*

According to Bronfenbrenner (1979), environments such as a home, a preschool, a recreation center [school-age educare] and a school can be understood as microsystem environments that influence a child's development through activities that he or she is engaged in, roles that he or she chooses or is given, and relationships that are formed within these microsystem environments. A child can belong to several microsystem environments and carry experiences between these, for example a situation that has taken place at home may impact what is taking place in school. Interplays of different kinds between microsystem environments are located in the mesosystem. The two subsequent systems, the exosystem and the macrosystem, are in comparison to the microsystem and mesosystem more indirect and distal from the children. Two examples of influences related to the exosystem are parents' work (e.g. how much time is spent with work and with their children) and the economics of a child's school districts (e.g. the available resources for a preschool and a preschool class). Four examples of influences related to the macrosystem are cultures, social structures, belief systems and national regulations.

In the period after 1979, during the 80's and the 90's, the ecology of human development was revised so that attention should also be paid to the role of the developing person and the biosystem (e.g. disabilities, abilities and engagement), the role of the proximal processes (i.e. primary engines for development such as group or solitary play, reading, learning new skills, athletic activities and problem solving) and the role of time, along with the role of the context on development (Bronfenbrenner & Morris, 1998). In the bioecological model the proximal processes are defined as "enduring forms of interaction in the immediate environment" (Bronfenbrenner & Morris, 1998, p. 996). Bronfenbrenner (2001) also presents the following description of proximal processes and human development: "Over the life course, human development takes place through processes of progressively more complex reciprocal interaction between an active, evolving biopsychological human organism and the persons, objects, and symbols in its immediate external environment" (p. 6). Proximal processes include significant others for the developing child, such as a mother, a father, a teacher and/or a friend. Thus, the name of the model was changed from the ecological model for human development to the bioecological model for human development and later the Process–Person–Context–Time (PPCT) model.

Uses and misuses of the bioecological model for human development in research

Theoretical reviews (Tudge, Mokrova, Hatfield, & Karnik, 2009; Tudge, Payir, Merçon-Vargas, Cao, Liang, Li, & O'Brien, 2016) have shown that the bioecological model and its mature form in the PPCT-model is sometimes misused by researchers. There are, according to these reviews, researchers who state that the bioecological theory of human development provide the theoretical, conceptual and analytical foundation for their stud-

ies, but their studies do not contain, describe, test or evaluate the concepts of proximal processes, person characteristics (i.e. biosystem) and time (i.e. chronosystem). Tudge et al. (2016) and Tudge (2017) recommend researchers, who claim that their research is based on the bioecological model and its PPCT-model, to present Bronfenbrenner's theory correctly in its mature form, to consider all four dimensions of the PPCT-model and to describe, test and analyze the interplay and synergistic relations among those dimensions.

Rosa and Tudge (2013), who have investigated and described the evolution of Bronfenbrenner's theory, have also noticed misuses of the bioecological theory and its PPCT-model. Due to this they recommend researchers to be explicit about which version of the model they us. It can be (a) the ecological model containing the famous concepts of microsystem, mesosystem, exosystem and macrosystem; (b) the bioecological model including these four famous concepts along with the biosystem and the chronosystem; *or* (c) the PPCT-model describing the influences of proximal processes, person, context and time on human development. If researchers are explicit about which version they use, theoretical incoherence, conceptual confusion and misuses can be avoided. They conclude that "scholars should be cautious about stating that their research is based on Bronfenbrenner's theory without specifying which version they are using" (Rosa & Tudge, 2013, p. 243).

The bioecological content analysis

In the following section of the article, the matrix of the biological content analysis is presented, as well as the process and phases of bioecological analyses for large and small scale life story studies.

The matrix for the bioecological content analysis

In Table 1, the matrix for the bioecological content analysis is presented. The matrix encompasses the six systems from the bioecological model and their relation to the notions of person, process, context and time within the PPCT-model. The matrix also encompasses a column for the respondents; a column for the central content in the interviews (life story oriented); and a column for the researcher's reflections that emerge during readings of interviews as well as during analyses of the central content. Each column is expandable and can contain as many notes as necessary. In Table 1, the matrix includes a total of six respondents but it is possible to include as many respondents as needed.

In Table 2, extracts from a bioecological matrix adopted in a life story oriented study with parents (Sandström, Lundqvist, & Axelsson, 2019) is provided. The extracts come from one out of 27 stories analysed in that study.

The analysis technique and the matrix was first and foremost developed to facilitate the analysis of more than a few retrospective (life story) interviews about human development, but it can also facilitate the analysis of one or a few retrospective (life story) interviews.

Outline of the bioecological content analysis

The outline (the process and its phases) of the bioecological content analysis technique is presented in Table 3 and Table 4. The analysis technique is slightly different in a large scale life story study, than in a small scale life story study.

Phases and process of a bioecological content analysis – large scale study

A large scale life story study refers to a study with several retrospective life story oriented interviews that are analyzed and presented in a scholar report. The process and the phases of a bioecological content analysis are the following in a large scale life story study (Table 3):

In *phase 1*, the recorded data are transcribed. In *phase 2*, readings of the transcriptions are conducted in order to gain an overall understanding of the data. In *phase 3*, all the relevant contents in each and every interview that can be related to the biosystem (i.e. the person); the context (i.e. the microsystem, proximal processes, mesosystem, exosystem and macrosystem); and the time that goes by (i.e. chronosystem) are coded. In this phase, the coded data within each

and every interview are also checked against each other and re-coded if needed. In *phase 4*, the coded data are transferred into the matrix.

In *phase 5,* the researcher once again reads the biosystem data in the matrix, reflects upon these data and creates biosystem subcategories. Biosystem subcategories are groups of human beings, for example children with special educational needs, typically developing children *or* gifted and talented children. Biosystem subcategories should reflect similarities and differences between the developing persons described in the interviews. Further examples are healthy children *or* unhealthy children; social competent children *or* children with difficulties in social interaction and play; and preterm birth *or* normal birth.

Table 1.
A bioecological matrix – The matrix for the bioecological content analysis

System	Respondent	Coded central content in the interviews with parents:	Reflections:
Person			
Biosystem: Child's age, characteristics, interests, talents, needs, roles and disabilities, etc.	1	…	…
	2	…	…
	3	…	…
	4	…	…
	5	…	…
	6	…	…
Context			
Microsystem: Characteristics of child's home, learning environments and recreation activities, as well as significant others and **proximal processes** in these environments.	1	…	…
	2	…	…
	3	…	…
	4	…	…
	5	…	…
	6	...	…
Mesosystem: Characteristics of school-home collaboration and child's transitions between micro environments.	1	…	…
	2	…	…
	3	…	…
	4	…	…
	5	…	…
	6	…	…
Exosystem: Distal influences on child's development. The allocation of resources in municipalities, team support for teachers' and parents' work situation.	1	…	…
	2	…	…
	3	…	…
	4	…	…
	5	…	…
	6	…	…
Macrosystem: Distal influences on child's development. Cultural aspects and content of national and international declarations, conventions and laws.	1	…	…
	2	…	…
	3	…	…
	4	…	…
	5	…	…
	6	…	…
Time			
Chronosystem: Descriptions of changes over time in the biosystem and the other contextually/ecologically oriented systems, as well as turning points.	1	…	…
	2	…	…
	3	…	…
	4	…	…
	5	…	…
	6	…	…

Note. Spaces for coded data obtained from interviews, (…). "Reflections" refer to the researchers' considerations that emerge during readings of interviews and analyses of the central content. The matrix can not only be used in interviews with parents, but also with others.

Table 2.
Extracts from a bioecological matrix used in a life story research

System	Respondent	Coded central content in the interview with the parents:	Reflections:
Person			
Biosystem: Child's age, characteristics, interests, talents, needs, roles and disabilities, etc.	11	Boy. Six years old. Very clever. Reads very well. Remembers everything you say and that he reads. Thinks a lot. Very shy but very social. High demands on himself. Loves roles. Loves chess. Difficulties in fine motor skills. Fantastic expressions and a large vocabulary, etc. …	The child is described as being gifted and talented.
Context			
Microsystem: Characteristics of child's home, learning environments and recreation activities, as well as significant others and **proximal processes** in these environments.	11	Home: Gives him intellectual stimulations in reading and mathematics, etc. Preschool: Terrible. He cried a lot. The staff did not say hello. He did not like the staff. The staff said he was very able, but that he needed to practice to use scissors, etc. Preschool class: Big group. Play with older children. Recreation activities: Nervous, does not like these. Proximal processes in preschool and preschool class: Were not intellectually stimulating, etc. …	Too few intellectual stimulations in the learning environments over time. Limited knowledge about gifted and talented children. Parents compensate for shortcomings in preschool and preschool class.
Mesosystem: Characteristics of school-home collaboration and child's transitions between micro environments.	11	School-home collaborations: Via meetings, etc. An involved and concerned parent. Transition to preschool class: A chock. Too few rules, etc. …	A concerned parent.
Exosystem: Distal influences on child's development. The allocation of resources in municipalities, resource team support for teachers' and parents' work situation.	11	No data could be related to the exosystem.	Tells about direct and proximal influences, not indirect and distal influences.
Macrosystem: Distal influences on child's development. Cultural aspects and contents of national and international declarations, conventions and laws.	11	No data could be related to the macrosystem.	Little attention is paid to gifted and talented children at a macro system level in Sweden.
Time			
Chronosystem: Descriptions of changes over time in the biosystem and the other contextually/ecologically oriented systems, as well as turning points.	11	Less shy in preschool class than in preschool thanks to the new social relationships in preschool class. A too quick role change from a child to a student, etc. …	Grows up too quick due to older friends: perhaps they provide him with the intellectual stimulation he needs?

Note. Columns 3 and 4 entitled "Coded central content in the interviews" and "Reflections" contain examples of one coded and analysed retrospective interview (respondent number 11) from a study by Sandström, Lundqvist and Axelsson (2019).

In *phase 6*, the researcher once again reads the microsystem data in the matrix, reflects upon these data and creates microsystem subcategories. Microsystem subcategories are settings that contain the developing person being described in the interviews, for example a warm and well-functioning home situation *or* a destructive and neglecting home situation; a low quality preschool *or* a high quality preschool; an inclusive leisure club *or* a segregated leisure club; and a positive peer interaction *or* victimization. Toward the end of this phase, the microsystem subcategories can be related to the other systems' subcategories. Calculations can be made.

In *phase 7*, the researcher once again reads the mesosystem data in the matrix, reflects upon these data and creates mesosystem subcategories. Mesosystem subcategories are linkages and processes taking place between microsystem settings, for example; low quality cooperation between home and school, linkage between a home and a leisure club, and high quality transition from a preschool to a school. Toward the end of this phase, the mesosystem subcategories can be related to the other systems' subcategories. Calculations can be made.

In *phase 8*, the researcher once again reads the exosystem data in the matrix, reflects upon these data and creates exosystem subcategories. Exosystem refers to indirect and distal influences on a child's development (e.g. how much time parents work; allocations of resources to a child's school from a municipality; cooperation between a special educator/school psychologist working at a local hospital and a child's teachers). Some examples of exosystem subcategories are the following: full *or* part time working parents; sufficient *or* insufficient adequate resources at school; and a meaningful *or* inefficient multidisciplinary cooperation that aims to enhance and facilitate the child's development. Toward the end of this phase, the exosystem subcategories can be related to the other systems' subcategories. Calculations can be made.

In *phase 9*, the researcher once again reads the macrosystem data in the matrix, reflects upon these data and creates macrosystem subcategories. Macrosystem is about overarching patterns such as traditions, cultures and laws and examples of macrosystem subcategories are a fulfilled *or* not fulfilled right of a child; and an achieved *or* not yet achieved national learning objective. Toward the end of this phase, the macrosystem subcategories can be related to the other systems' subcategories. Calculations can be made.

In *phase 10*, the researcher once again reads the chronosystem data in the matrix, reflects upon these data and creates chronosystem subcategories. Chronosystem is about changes over time and examples of chronosystem subcategories are a positive social and academic growth of a child; an improved school situation for a child with special educational needs due to an increase in resources and support to that child's teacher; and an increase in health of a child after a medical treatment. Toward the end of this phase, the chronosystem subcategories can be related to the other systems' subcategories. Calculations can be made.

Finally, in *phase 11*, a written scholarly report is produced. It should encompass a methodological description of the bioecological content analysis conducted, a result presentation and a discussion in which the result is explained and related to prior research.

The process and phases of a bioecological content analysis – small scale study

A small scale life story study encompasses *few* retrospective life story oriented interviews that are to be analyzed and presented in a scholar report. The process and the phases are the following in a small scale life story study (Table 4):

The recorded data from interviews are transcribed (phase 1) and readings of the transcriptions are conducted in order to gain an overall understanding of the data (phase 2). All the relevant contents in each and every interview that can be related to the systems are coded (phase 3). The coded data are then transferred into the matrix (phase 4). In phase 5, a constructed and shortened life story (a summary) for each and every respondent

–by means of data in matrix – is created. In phase 6, the life stories are compared with the aim to find similarities and differences. Finally, a written scholarly report of the analysis is produced (phase 7). It should encompass a methodological description of bioecological content analysis, a result presentation and a discussion in which the result is explained and related to prior research.

The major difference between the bioecological content analysis for large and small scales life story research is that no shortened life stories are created and presented in large scale studies, and that the terms biosystem subcategories, microsystem subcategories, mesosystem subcategories, exosystem subcategories, macrosystem subcategories and chronosystem subcategories are not taken on in small scale studies. These can of course be taken on in small scale studies if considered useful and valuable.

Perfomance of a bioecological content analysis – two examples

An example of a large scale study using a bioecological content analysis

A bioecological content analysis (the first draft) was taken on in a study about parenthood, development and early childhood education and care in Sweden (Sandström, Lundqvist, & Axelsson, 2019). Bronfenbrenner's bioecological model was adopted as a theoretical, conceptual and analytical frame and proximal processes were acknowledged as engines for human development. A total of 27 parents were interviewed and asked to describe characteristics of their children; characteristics of their children's learning environments; significant others for their children; their collaboration with staff in these environments, their children's educational transition from preschool to preschool class, and changes over time on such matters as support needs. The parents' descriptions of their children's early childhood education and care were discussed and related to national laws and regulations. The scholar report took the form of a research article (Sandström, Lundqvist, & Axelsson, 2019). In accordance with the bioecological content analysis for large scale life story studies, the following process was performed:

The recorded data from the 27 interviews were transcribed (phase 1) and readings of the transcriptions were conducted in order to gain an overall understanding of the data (phase 2). All the relevant contents in each and every interview that could be related to the systems were coded (phase 3). The coded data were then transferred into the matrix (phase 4).

After several readings of the biosystem data in the matrix, similarities and differences between the parents' descriptions of the children emerged (phase 5). The children were by their parents described as children with special educational needs, as typically developing children, *or* as gifted and talented children. Calculations were made on the total number of children in each group (i.e. biosystem subcategory).

After several readings of the microsystem data similarities and differences between the parents' descriptions of the children's microsystem settings emerged (phase 6). The children's preschool and preschool classes were described as (a) low in quality, (b) partly low and partly high in quality *or* (c) high in quality. Calculations were made on the total number of learning environments being low, partly low and high, *or* high in quality. These three microsystem subcategories were related to the children's groups (i.e. biosystem subcategories). One example of this was that the learning environments of the children with special educational needs were commonly considered to be partly low and partly high in quality.

Table 3.
The phases and process of a bioecological content analysis – large scale life story study

Phases (N=11)	Process
To transcribe (1).	Write out voice recorded data.
To become familiar with the collected data (2).	Reading of transcriptions in order to gain an overall understanding of data.
To code the data in each and every interview as related to the biosystem (i.e. the developing person); the microsystem, proximal processes, the mesosystem, the exosystem, and the macrosystem (i.e. the context); and the chronosystem (i.e. the time) (3).	All relevant extracts in each and every interview that can be related to the biosystem (i.e. the developing person), the microsystem, the proximal processes, the mesosystem, the exosystem, the macrosystem (i.e. the context), and the chronosystem (i.e. the time) are coded. Different strategies can be used during coding, for example; one colour for each system during coding in transcriptions, or short notes (e.g. bio, micro, p.p. [proximal process], meso, exo, macro and chrono) in the right and/or left margin of transcriptions. The coded data within each and every interview are checked against each other and re-coded if needed.
To transfer the coded data into the matrix (4).	Fill in the matrix according to the coding made (column 3 in the table 1).
To become familiar with the biosystem data in the matrix, reflect upon these data and to create biosystem subcategories (5).	Reading of biosystem data in the matrix in order to gain an overall understanding of each and every person's characteristics. To reflect upon the biosystem data and fill in the matrix (column 4 in the table 1). To search for similarities and differences between the persons, and to divide them into groups by characteristics (create biosystem subcategories). To review subcategories and to generate clear definitions and names for each biosystem subcategory.
To become familiar with the microsystem data in the matrix, to reflect upon these data, to create micro system subcategories and to relate these subcategories to the other system subcategories (6).	Reading of microsystem data in the matrix in order to gain an overall understanding of each and every person's settings and proximal processes. To reflect upon the microsystem data and fill in the matrix (column 4 in the table 1). To search for similarities and differences between the microsystem settings, and to create microsystem subcategories. To review subcategories and to generate clear definitions and names for each category. To search for links between microsystem subcategories and other system subcategories identified in data.
To become familiar with the mesosystem data in the matrix, to reflect upon these data, to create mesosystem subcategories and to relate these to other system subcategories (7).	Reading of mesosystem data in the matrix in order to gain an overall understanding of linkages and processes taking place between microsystem settings. To reflect upon the mesosystem data and fill in the matrix (column 4 in the table 1). To search for similarities and differences between persons' mesosystems and to create mesosystem subcategories. To review subcategories and to generate clear definitions and names for each category. To search for links between mesosystem subcategories and other system subcategories identified in data.
To become familiar with the exosystem data in the matrix, to reflect upon these data, to create exosystem subcategories and to relate these to the other system subcategories (8).	Reading of exosystem data in matrix in order to gain an overall understanding of indirect and distal influences on development such as parents' workplace. To reflect upon the exosystem data and fill in the matrix (column 4 in the table 1). To search for similarities and differences between persons' exosystems and to create exosystem subcategories. To review subcategories and to generate clear definitions and names for each category. To search for links between exosystem subcategories and other system subcategories identified in data.
To become familiar with the macrosystem data in the matrix, to reflect upon these data, to create macrosystem subcategories and to relate these to the other system subcategories (9).	Reading of macrosystem data in the matrix in order to gain an overall understanding of indirect and distal influences on development such as characteristics of a given culture, belief systems and national resources. To reflect upon the macrosystem data and fill in the matrix (column 4 in the table 1). To search for similarities and differences between macrosystem described and to create macrosystem subcategories. To review subcategories and to generate clear definitions and names for each category. To search for links between macrosystem subcategories and other system subcategories identified in data.
To become familiar with the chronosystem data in the matrix, to reflect upon these data, to create chronosystem subcategories and to relate these to the other system subcategories (10).	Reading of chronosystem data in the matrix in order to gain an overall understanding of changes over time and turning points on such matters as proximal processes, person characteristics and context. To reflect upon the chronosystem data and fill in the matrix (column 4 in the table 1). To search for similarities and differences between persons' chronosystems and to create chronosystem subcategories. To review subcategories and to generate clear definitions and names for each category. To search for links between chronosystem subcategories and other system subcategories identified in data.
To produce a scholarly report of the analysis (11).	Writing the result of analysis, that is to present the created biosystem subcategories, microsystem subcategories, mesosystem subcategories, exosystem subcategories, macrosystem subcategories and chronosystem subcategories, and to present the linkages identified between system subcategories. The result presentation may include text, tables and figures, and these may incorporate quantitative data about linkages between system subcategories. The result presentation should include persuasive extract examples from the interviews. To write the discussion of analysis.

In phase 7, the authors became familiar with the mesosystem data in the matrix. Examples of mesosystem subcategories identified were (a) low quality preschool class-home collaboration, (b) partly low and high quality preschool class-home collaboration, and (c) high quality preschool class-home collaboration. Another example was low/partly low and high/high quality transitions from preschool to preschool class. Calculation were made, for example, of the total number of collaboration being low/partly low and partly high/ high in quality, and related to biosystem subcategories. One example of this was that the parents of the children with special educational needs commonly felt their collaboration with staff members to be partly low and partly high in quality. Another example of this was that twelve out of the 27 parents (44%) considered the transitions to be high in quality (i.e. smooth, easy and well-prepared).

The interviews, with few exceptions, did not encompass extracts that could be coded as exosystem and macrosystem data (phase 8 and 9). Hence, the study suggests that parents who describe characteristics of their children; characteristics of their children's learning environments; significant others for their children; their collaboration with staff in these environments; their children's educational transition from preschool to preschool class and changes over time on such matters as support needs can be focused on proximal and direct influential factors, and not on distal and indirect influences.

In phase 10, the authors became familiar with the chronosystem data and related these to the other system subcategories. Changes that could be related to time, context, person and proximal processes were found: The study, for example, comprises a description of a child who changed group (i.e. biosystem subcategory) from preschool to preschool class, and descriptions of parents who changed from being unconcerned during child's preschool period to being concerned during child's preschool class period.

Table 4.
The phases and process of a bioecological content analysis – small scale life story study

Phases (N=7)	Process
To transcribe (1).	Writing out voice recorded data.
To become familiar with the data collected (2).	Reading of transcriptions in order to gain an overall understanding of data.
To code the data in each and every interview (3) as related to the biosystem (i.e. the developing person); the microsystem, proximal processes, the mesosystem, the exosystem, and the macrosystem (i.e. the context); and the chronosystem (i.e. the time).	Coding of all relevant extracts in each and every interview that can be related to the biosystem (i.e. the developing person), the microsystem, the proximal processes, the mesosystem, the exosystem, the macrosystem (i.e. the context), and the chronosystem (i.e. the time) are coded. Different strategies can be used during coding, for example; one colour for each system during coding in transcriptions, or short notes (e.g. bio, micro, p.p. [proximal process], meso, exo, macro and chrono) in the right and/or left margin of transcriptions. The marked data within each and every interview are checked against each other and re-coded if needed.
To transfer the coded data into the matrix (4).	Filling in the matrix according to the coding made (column 3 in the table 1).
To create a written life story, that is a summary for each and every respondent's retrospective life story interview (5).	Reading of biosystem data, microsystem data, mesosystem data, exosystem data, macrosystem data and chronosystem data in matrix for each and every respondent. To reflect upon these data (column 4 in the table 1). To create a shortened and written life story for each and every respondent by means of the coded data in the matrix. To review life stories created to ensure that aspects related to time, context, person and proximal processes are part of the story.
To compare life stories (6).	Comparing life stories and to search for similarities and differences on such matters as proximal processes, person characteristics, context and time, as well as matters such as intellectual, social, emotional and moral development.
To produce a written scholarly report of the analysis (7).	Writing the result of analysis: To present the constructed life stories, as well as similarities and dissimilarities. The result presentation should include life stories with extract examples from the interviews. To write the discussion of analysis.

This written scholar report (Sandström, Lundqvist, & Axelsson, 2019) incorporates descriptions of biosystem subcategories and the other system subcategories, as well as presentations of calculations made between biosystem subcategories and other system subcategories. Worth mentioning is that the term subcategory was not used in that study since subcategories were not part of the first draft of analysis technique and matrix – these had not yet been formed. The term became part of the bioecological content analysis later in its mature version outlined in this article. The result of the written scholar report also incorporates an analysis of the parents' Ideal type approaches to their children's preschool pathways, and a discussion of the result. The use of the bioecological content analysis enabled the authors to create Ideal types, since the different system subcategories were taken into account – thus, different Ideal types emerged.

An example of a small scale study adopting a bioecological content analysis

A bioecological content analysis (the first draft) was taken on in a study of Axelsson, Lundqvist and Sandström (2017) encompassing data from three life story interviews with parents. The study was based on Bronfenbrenner's bioecological model and acknowledged proximal processes as engines for human development. The scholar report took the form of a book chapter. In accordance with the bioecological content analysis for small scale life studies, the following process and phases were conducted:

The recorded data from the three interviews were transcribed (phase 1) and readings of the transcriptions were conducted in order to gain an overall understanding of the interviews (phase 2). All the relevant contents in each and every interview that could be related to the systems were coded (phase 3). The coded data were then transferred into the matrix (phase 4). In phase 5, written shortened life stories for each and every respondent by means of data in the matrix were constructed (phase 5) and in phase 6 these were compared. The study showed, for example, that children's educational pathways from preschool to preschool class differ; that parents can worry about support provisions; and that parents are very much involved in their children's early education and help staff to solve difficult situations. In phase 7, a scholarly report of the analysis was written.

The book chapter (Axelsson, Lundqvist, & Sandström, 2017) incorporates three shortened life stories. These life stories are located in the beginning of the result. All of these have substances that can be related to the systems and the notion of proximal processes, person, context and time. The result of the written scholar report also incorporates identified similarities and differences, and a discussion of the result.

Advantages and disadvantages of the bioecological analysis technique

The bioecological content analysis is a new technique that, from our perspective and experiences, can be useful and valuable in life story research framed by Bronfenbrenner's bioecological theory of human development. There are several reasons for this: The analysis technique (both in large and small scale life story studies) and its matrix reminds that the mature bioecological theory for human development (and the PPCT-model) is not only about contextual influential aspects of human development, but also about personal characteristics, proximal processes and the time that goes by. Hence, the analysis technique may reduce the risk for misuses of Bronfenbrenner's mature theory in research and hold back theoretical incoherence and conceptual confusion. The analysis technique (both in large and small scale life story studies) also makes it possible to take influences of both nature and nurture into account in research analyses on human development. Therefore, the analysis technique can be useful and valuable in multidisciplinary research in which multiple personal, and proximal and distal influential factors, shall be taken into account. Moreover, the analysis technique also makes it possible to integrate both quantitative and qualitative data, and results that are integrating words and numbers.

Furthermore, the analysis technique for large scale studies can be useful and valuable for researchers who plan to present their results in a scholar report taking the form of a research article. Articles often have a word limit that does not allow for the

presentation of several life stories, even if the life stories have been much shortened. Therefore, the analysis technique may increase the number of research articles being based on life story research, and this may in its turn increase the knowledge and understanding of several phenomena from individual perspectives. The analysis technique for small scale studies can be useful and valuable for researchers who plan to present their results in a scholar report incorporating written and shortened life stories. The bioecological content analysis technique can help structure life stories from biosystem to chronosystem, and remind of taking into account all the four dimensions of the PPCT-model during the construction of shortened life stories.

Potential disadvantages and limitations of the analysis technique should also be pointed out: The analysis technique is basically keeping with the thoughts of the bioecological theory for human development and does not question, test or evaluate the theory. Another disadvantage is that the analysis technique for large scale life stories suggests that shortened life stories are not needed in written scholar reports. This can be understood as problematical: Life stories are indeed a central part in life story research and they give life to reports.

It is possible, but not yet tested, evaluated or confirmed, that the bioecological content analysis for large and small scales studies can be useful and valuable in research that encompasses other interview types than those used in life story research. It may also be useful and valuable in studies collecting data via focus groups, documents and observation notes. More research on the bioecological content analysis is needed.

The recommendation to future researchers who take on a bioecological content analysis in a large or small scale study (based on life story research and interviews, or other data collection methods and research approaches) on such matters as children with special needs and their families, early intervention and early childhood special education is to incorporate a methodological reflection on the feasibility of the analysis technique in their studies and written scholar reports, and to put forward issues that need to be improved and revised in the bioecological content analysis.

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