Child Development and Parental Behaviour: 
Measuring and Understanding what Happens in Families

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Yale, IFS, FAIR & NBER

joint work with Ingvild Almås and Pamela Jervis

CGD Birdsall House Conference
December 10th 2019
1. Introduction

2. How to use and improve existing measures.
   2.1 Child Development

   3.1 Bargaining power
   3.2 Beliefs
   3.3 Preferences

4. Using these measures.

5. Conclusions
In recent years, child development, especially in the early years, has received renewed attention.
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Early years development is important:
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- It is malleable, and therefore salient for policy interventions.
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Considerable research work and policy effort has been devoted to this:
- Heckman’s work;
- *Reach Up and Learn*;
- Many others....
Much progress has been made;
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We have a better understanding of the process of child development;
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We are starting to understand which policies work and when;
Introduction

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- We are starting to understand which policies work and when;
- ...but much remains to be done:
We are still missing important pieces of the process of child development:

- What dimensions and their interactions;
- The dynamics of the process;
- The interaction of different inputs;
An agenda

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  - What drives parental investment;
  - How parent allocates resources within the household;
  - Who makes decision and controls resources.
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  - What resources;
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- How do we measure outcomes and inputs.
The importance of measurement

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- More realistic and richer models of individual behaviour can be identified with richer and better measures.
An agenda on measurement

- Much work needs to be done in measurement:
  - Using existing measures better;
  - Building new tools;
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    - GCDG D-score;
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    - CREDI.
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Measurement and connected issues are relevant for the themes I will discuss.
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- Measure bargaining power within the marriage.

Use these measures to identify and characterize parental behaviour and child development.
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How to use and improve existing measures.

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- Different researchers might use different theoretical frameworks.
- In the case of Child Development:
  - What dimensions?
  - How many dimensions?
  - What is the research question and what measurement is more adequate for that question?
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- Measurement error is pervasive.
- The perfect data does not exist.
Measuring child development is hard

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- Some of the measures that are considered the ‘gold standard’ are very expensive:
  - The Bayleys scales of infant development (BSID) take about 1.5 hours to administer;
  - They need to be administered by a specially trained psychologist;
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- Unfortunately alternative ‘cheap’ measures can be very noisy.
How to use and improve existing measures.

How good are cheap measures?

Results from Araujo, Attanasio, and Rubio-Codina (2016)

Correlations with Bayley Cognition

Correlación

ASQ3 Res. Problemas (0.160)
ASQ3 Comunicación (0.218)
Battelle Cognitivo (0.302)
Battelle Lenguaje (0.308)
Denver Mot. Fina (0.316)
Denver Lenguaje (0.274)
How to use and improve existing measures.

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Results from Araujo, Attanasio, and Rubio-Codina (2016)

Correlations with Bayley Expressive Language

Correlation

- ASQ3 Comunicación (0.406)
- Denver Lenguaje (0.470)
- Battelle Lenguaje (0.472)
- MacArthur Leng. Exp.* (0.475)

* 8 - 30 meses
Interpreting existing measures

- A useful measurement model: (see Cunha et al (2010)):

\[ m_{i,t}^{j,k} = \alpha_{j,k} + \beta_{j,k} \theta_{i,t} + \epsilon_{i,t}^{j,k} \]

where
- \( \theta_{i,t}^{j,k} \) is factor \( j \) for individual \( i \) at time \( t \)
- \( m_{i,t}^{j,k} \) is measure \( k \) for factor \( j \)
- \( \epsilon_{i,t}^{j,k} \) is measurement error
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- **Assumptions**
  - Measurement errors are additive;
  - Measurement errors are independent across measures;
  - There are at least 2 measures;
  - Some normalizations on \( \alpha \)'s and \( \beta \)'s are necessary to define the scale and location of the measures;
  - Typically some assumptions are made on the distribution of measurement error.
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- We can then estimate the parameters of this model and use the available measures to get an estimate of the factors.
Interpreting existing measures

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- Often available measures use pre-defined scoring algorithms.
- Examples
  - Mac Arthur Language Inventory Scales;
  - Bayleys Scales of Infant Development;
  - Woodcock Johnson measures;
- These scales are typically estimated on obsolete samples and/or are over-simplified.
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- Examples
  - Mac Arthur Language Inventory Scales;
  - Bayleys Scales of Infant Development;
  - Woodcock Johnson measures;
- These scales are typically estimated on obsolete samples and/or are over-simplified.
- It is useful to write down the model, especially when running surveys:
  - One can design survey methods to ensure that crucial assumptions hold in the data;
Existing measures: scaling and anchoring

- Often ‘gold standard’ measures are made of many items.
- Estimates of the measurement systems can used to construct cheaper and more effective measures.
- One can choose relatively few items characterised by ‘high’ $\beta$’s and different and diverse $\alpha$’s.
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- One can choose relatively few items characterised by ‘high’ $\beta$’s and different and diverse $\alpha$’s.
- Issues when different items are available over different ages or different cohorts…. which imposes challenges on scaling and anchoring.
  - Some interesting work by Agostinelli and Winswall (2018) on this issue.
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Often the right strategy depends on the question one is asking.

Attanasio, Blundell, Conti and Mason (2019) try to compare the distribution of child development at 11 in two British cohorts.

Attanasio, Bernal, Giannola and Nores (2019) look at child development from age 6 to 72 months.
An example from Tanzania

- We run a pilot in Tanzania to improve existing measures of child development;
- We start from standard measures.
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- One of the objectives is scalability of the new measures.
An example from Tanzania

- We run a pilot in Tanzania to improve existing measures of child development;
- We start from standard measures.
- We estimate relevant indexes from existing items and tests.
- We use these estimates to select the most informative items and propose new measures.
- One of the objectives is scalability of the new measures.
- I will discuss four types of measures:
  - Novel indicators of child development;
  - Bargaining power within the marriage;
  - Parental beliefs about the process of child development;
  - Parental tastes and preferences.
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Measuring child development

- We measure different dimensions:
  - Cognition;
  - Language;
  - Socio-emotional skills.
Measuring child development

- We measure different dimensions:
  - Cognition;
  - Language;
  - Socio-emotional skills.

- We use different approaches to measure:
  - Testing the child;
  - Maternal report;
  - Filming.
Scalable data collections: constructing new tests

- In our approach we start from a large number of items taken from a variety of tests.
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Scalable data collections: constructing new tests

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- Factor analysis allows us to identify items that are particularly informative.
- Latent factors can be then estimated based on a reduced number of items.
- In a second step, we collect the reduced set of items as a template for a new test and validate them in a different sample.
An example on language development

- The MacArthur Language Inventory test (MLI) is a widely used instrument to measure the development of language skills among very young children.

- It is based on maternal reports:
  - Mothers are asked whether their child understands (or says, depending on the age) certain words;
  - There are about 100 words.

- It is a very good test:
  - language is very salient for development and mothers are aware of it.
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- It is based on maternal reports:
  - Mothers are asked whether their child understands (or says, depending on the age) certain words;
  - There are about 100 words.
- It is a very good test:
  - language is very salient for development and mothers are aware of it.
- The standard algorithm to score it sums the words.
- There is no good reason to use that algorithm.
An example on language development

- In Tanzania we collected the MLI on about 400 children aged 6 to 42 months.
An example on language development

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- The distribution of the raw score is the following.

![Graph showing the distribution of raw scores.](image)
An example on language development

- In Tanzania we collected the MLI on about 400 children aged 6 to 42 months.
- The distribution of the raw score and of the estimated latent factor are the following.

Note: Correlation is equal to 0.93.
An example on language development

- The next step is to select the most informative items (high loading factors $\beta$’s)

Note: Correlation is equal to 0.95.
Constructing a new test of cognitive development

- The next step was to analyse a variety of items from different standard tests;
- We used the cognitive items from the Bayles Scores of Infant Development (BSID -III) (70 out of 91 items);
- Some items from CREDI
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- Some statistics from that exercise

(a) IRT - Psychometrics
Constructing a new test of cognitive development

- We plot the density of factors estimates based on:
  1. Complete cognition Bayley (70 out of 91 items);
  2. Selected items (17 items);
  3. Selected items in a new sample.

Stage 1 and Stage 2 Factor Comparison

Cognition Development - Direct Assessment

- Correlation in baseline sample between extended and reduced measure $= 0.975$. 
Constructing a new test of cognitive development

- We plot the density of factors estimates based on:
  - Complete cognition Bayley (91 items);
  - Selected items (15 items from Bayley and 7 from Credi);
  - Selected items in a new sample.

Stage 1 and Stage 2 Factor Comparison

Correlation in baseline sample between extended and reduced measure = 0.961.
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Measuring the drivers of child development.

Measuring new concepts

- In a number of important economic models the possibility of measuring new factors can allow the estimation of models subject to less stringent assumptions.

Examples:

- Bargaining power within couples;
- Beliefs;
- Tastes:
  - Altruism;
  - Discount factors;
  - Risk aversion
  - Taste for redistribution;

- Subjective expectations: means
- Subjective expectations: variances and risk
- Information and its quality.
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- After the data collection, the wives were called to an office and were paused with the following question:
  - Here are 100 dinars that we will give to your husband, how much are you willing to pay to have them paid to you.
  - An additional hypothetical question with larger stakes.
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The results in Almås, Armand, Attanasio, and Carneiro (2018):

- Considerable variability, linked to several observables;

![Figure 2: Willingness to pay](image)

Table 8: ITT estimates of the effect of targeting payments on willingness to pay

<table>
<thead>
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<th>Dep.var.</th>
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<th>Exclude always herself</th>
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</tbody>
</table>

Note. The graph presents the distribution of participants by the share the participant is willing to pay in order to avoid that the partner becomes the recipient. A zero-WTP could also be obtained in the case of a woman with no bargaining power, perhaps because of social norms. This would be equivalent to a unitary model where household preferences coincide with the woman's preference. A woman living in a unitary household would report a zero-WTP. A woman with a very small bargaining power, which make their spending non-beneficial or even invoke negative effects for the spouse, such as spending on prostitution.

For example, when the initial stake is 600 MKD and the participant always chooses to be the recipient instead of her husband.

The intervention shifted considerably the willingness to pay.
The results in Almås, Armand, Attanasio, and Carneiro (2018):

- Considerable variability, linked to several observables;

![Figure 2: Willingness to pay](image)

- The intervention shifted considerably the willingness to pay.

Table 8: ITT estimates of the effect of targeting payments on willingness to pay

<table>
<thead>
<tr>
<th>Dep.var.: Include all observations</th>
<th>Willingness to pay Exclude always husband and always herself</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) OLS (2) OLS (3) OLS (4) OLS (5) OLS (6) OLS</td>
</tr>
<tr>
<td>Payment to mother</td>
<td>-0.057** -0.053** -0.053** -0.058*** -0.055*** -0.055***</td>
</tr>
<tr>
<td></td>
<td>(0.025) (0.024) (0.024) (0.021) (0.019) (0.020)</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>Yes Yes Yes Yes Yes Yes</td>
</tr>
<tr>
<td>Ethnicity controls</td>
<td>No Yes Yes No Yes Yes</td>
</tr>
<tr>
<td>Stake controls</td>
<td>No No Yes No No Yes</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.055 0.074 0.074 0.060 0.082 0.083</td>
</tr>
<tr>
<td>Observations</td>
<td>768 768 768 576 576 576</td>
</tr>
</tbody>
</table>
Bargaining power

- In our Tz sample we repeated the game;
- We now ask a sample of husband and a sample of wives.
Bargaining power

- In our Tz sample we repeated the game;
- We now ask a sample of husband and a sample of wives.

Pilot - Preliminary Results: average willingness to pay (out of 6 600 TZS)

<table>
<thead>
<tr>
<th></th>
<th>Mean women</th>
<th>Mean men</th>
<th>p-value of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2720</td>
<td>660</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>
Outline

1. Introduction

2. How to use and improve existing measures.
   2.1 Child Development

   3.1 Bargaining power
   3.2 Beliefs
   3.3 Preferences

4. Using these measures.

5. Conclusions
In Attanasio, Cunha and Jervis (2019) we measure beliefs held by mothers about the process of child development.
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The strategy consists in presenting mothers with *scenarios* in terms of initial conditions and investment and ask them to map these scenarios into child development outcomes.
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We design scenarios using existing data and factor analysis to choose salient markers of initial conditions and parental investment.
Beliefs

- In Attanasio, Cunha and Jervis (2019) we measure beliefs held by mothers about the process of child development.

- The strategy consists in presenting mothers with *scenarios* in terms of initial conditions and investment and ask them to map these scenarios into child development outcomes.

- We design scenarios using existing data and factor analysis to choose salient markers of initial conditions and parental investment.

- The implicit assumption is that mothers use the same mapping between latent factors and observable markers.
  - For child development we use language
  - For parental investment we use items from the FCI.
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The strategy consists in presenting mothers with *scenarios* in terms of initial conditions and investment and ask them to map these scenarios into child development outcomes.

We design scenarios using existing data and factor analysis to choose salient markers of initial conditions and parental investment.

The implicit assumption is that mothers use the same mapping between latent factors and observable markers.

- For child development we use language
- For parental investment we use items from the FCI.

This approach allows us to:

- Estimate rates of return to investment
- Estimate 'subjective production functions' and compare them to actual production functions.
Figure: Beliefs on Language
Pilot - Preliminary Results: Beliefs on Language

Figure: Beliefs on Language

- Easy words
- More difficult words
- A bit more difficult words
Beliefs on Language: Returns of Investment

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mothers</th>
<th>Fathers</th>
<th>p-value of diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Initial Condition (easy words)</td>
<td>0.449</td>
<td>0.325</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
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</tr>
<tr>
<td>High Initial Condition (easy and difficult words)</td>
<td>0.313</td>
<td>0.303</td>
<td>0.808</td>
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<tr>
<td></td>
<td>(0.024)</td>
<td>(0.035)</td>
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</tr>
</tbody>
</table>

Number of observations 246 126

Notes: The table shows the means for the returns of investment. The p-values for the test of difference between the mother and father subsamples are presented in the last column. Standard errors in parentheses.
Beliefs on Socio-emotional

Figure: Beliefs on Socio-emotional

Three years old

Five years old

Nine years old
### Table: Beliefs on Socio-emotional: Returns of Investment

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mothers</th>
<th>Fathers</th>
<th>Diff. means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Initial Condition (behave very badly)</td>
<td>0.344</td>
<td>0.188</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.035)</td>
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</tr>
<tr>
<td>High Initial Condition (behave very well)</td>
<td>0.282</td>
<td>0.227</td>
<td>0.112</td>
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<tr>
<td></td>
<td>(0.019)</td>
<td>(0.032)</td>
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</table>

Number of observations 246 126

Notes: The table shows the means for the returns of investment. The p-values for the test of difference between the mother and father subsamples are presented in the last column. Standard errors in parentheses.
Beliefs: the next steps.

- We have now collected data on beliefs in a longitudinal survey in India.
- We change slightly the formulation of the questions to introduce uncertainty about the process.
- This can allow us to study the evolution of beliefs.
- We can also better relate beliefs to other variables, both individual and environmental.
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5. Conclusions
Measuring the drivers of child development.

Preferences

Measuring tastes with hypothetical scenarios

- We use a hypothetical allocation game to elicit data on parents preferences for household allocations
  - Juster and Shay, 1964;
  - Kahneman, Knetsch, and Thaler, 1986;
  - Ringdal and Sjursen, 2017;
Measuring tastes with hypothetical scenarios

- We use a hypothetical allocation game to elicit data on parents preferences for household allocations
  - Juster and Shay, 1964;
  - Kahneman, Knetsch, and Thaler, 1986;
  - Ringdal and Sjursen, 2017;

- We ask the participants to allocate an amount of money to different expenditure categories and different household members.
  - The participants first allocate the endowment across different consumption categories such as food, clothing, education, health, luxury goods and transportation.
Measuring tastes with hypothetical scenarios

- We use a hypothetical allocation game to elicit data on parents preferences for household allocations
  - Juster and Shay, 1964;
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- We ask the participants to allocate an amount of money to different expenditure categories and different household members.
  - The participants first allocate the endowment across different consumption categories such as food, clothing, education, health, luxury goods and transportation.
  - Within each consumption category, the participant makes an allocation between the family members.
  - We randomize whether we interview the father, the mother or both.
“We would now like to understand how you would prefer to spend 300,000 X, if we were to give this money to you. Use these 60 beans that each represents 5,000 TSH, and cardboard card with 3 different expenditure options (for mother, for father, for your child); for each question distribute the beans according to your preferences. Imagine that your child is 5 years old for this exercise.

How much would you spend on .. (item) for .. (person)?”

FOR THE COUPLE: “Please discuss the options between you in the same way you make expenditure decisions in the household.”
Spending categories

- How much would you spend on Clothing?
- How much would you spend on Food?
- How much would you spend on School expenditures?
- How much would you spend on Learning materials such as books, notebooks, pens & pencils?
- How much would you spend on Health expenditures?
- How much would you spend on Transportation?
Expenditure allocations

Figure: Average share of expenditure allocated to household members

Note: This figure shows the average share of expenditure to household members for the different subsamples. The range plots show the one-standard errors around the shares.
### Preferences

<table>
<thead>
<tr>
<th>Category</th>
<th>Wife</th>
<th>Husband</th>
<th>p-value for difference</th>
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<tr>
<td><strong>Clothing</strong></td>
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<td>Standard deviation</td>
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<td><strong>School expenditure</strong></td>
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<td>7.529</td>
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<td><strong>Transportation</strong></td>
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Validation

- These measures are difficult to implement.
- Different types of validation are essential:
  - Predictive power but not only;
  - What are we measuring?
  - Variability and co-variability.
  - Comparison with actual choices in different samples.
Are these data useful?

- **Research question 1**: How are transfers targeted to mother versus father spent?
Are these data useful?

- **Research question 1**: How are transfers targeted to mother versus father spent?

- **Research question 2** ("the mechanism question"): Are (potential) differences between mothers and fathers due to different
  i. beliefs,
  ii. preferences,
  iii. bargaining power?
Are these data useful?

- **Research question 1**: How are transfers targeted to mother versus father spent?

- **Research question 2** (“the mechanism question”): Are (potential) differences between mothers and fathers due to different
  i. beliefs,
  ii. preferences,
  iii. bargaining power?

- We need to put all these measures together and model individual behaviour to answer question 2.
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Conclusions

- We need to understand parental behaviour to:
  - Understand child development;
  - Design effective policies;
Conclusions

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- Measurement is very important.
We need to understand parental behaviour to:
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Measurement is very important.

Much energy should be invested in using appropriately existing measures and constructing new measures.
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- Design effective policies;

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What we can measure should be broad.
Conclusions

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  - Design effective policies;

- Measurement is very important.

- Much energy should be invested in using appropriately existing measures and constructing new measures.

- What we can measure should be broad.

- How and what we measure should be driven by theory and by the questions we ask.
Conclusions

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  - Understand child development;
  - Design effective policies;

- Measurement is very important.

- Much energy should be invested in using appropriately existing measures and constructing new measures.

- What we can measure should be broad.

- How and what we measure should be driven by theory and by the questions we ask.
I have provided some examples that should be salient for these arguments. Many more could be provided:

- measuring networks and connections;
- measuring allocation across different children;
- measuring the quality of information;
- measuring different inputs in production processes and their role.