Models of study for ICT-supported educational programs, applications, and generalization to the non-ICT field

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Problem definition

ICT impact in Education

- ICTs in schools: to “transform” teaching and learning processes for better educational attainment
- But, there is still no conclusive answer about their impact
- **Why ICT did not have the expected effects?**

Problem definition

ICT impact in Education

- Dimensions affecting the impact of ICT:
  1. Design and implementation in real settings
  2. Evaluation of impact
  3. Scaling-up
  4. Cost-effectiveness

ICT impact in Education

1. Design and implementation

- **Design:**
  - ICT was not designed for educational purposes
  - Technology is put before pedagogy
  - Previous educational research was not used

- **Implementation**
  - Without valid theoretical support
  - Competes with the needs of the system, measured by standardized tests
  - Lack of adequate ICT monitoring initiatives, to learn from past experience

ICT impact in Education

2. Impact evaluation

- No accepted standard methodologies for measuring the impact

- Evaluation weakness are:
  - What to measure
  - What to measure with
  - How to measure

ICT impact in Education

2. Impact evaluation

What to measure

- Identifying the effects of ICTs
- Identifying how the ICT design and its curricular implementation affect students' attainment
- Teachers' pedagogical approaches

What to measure with

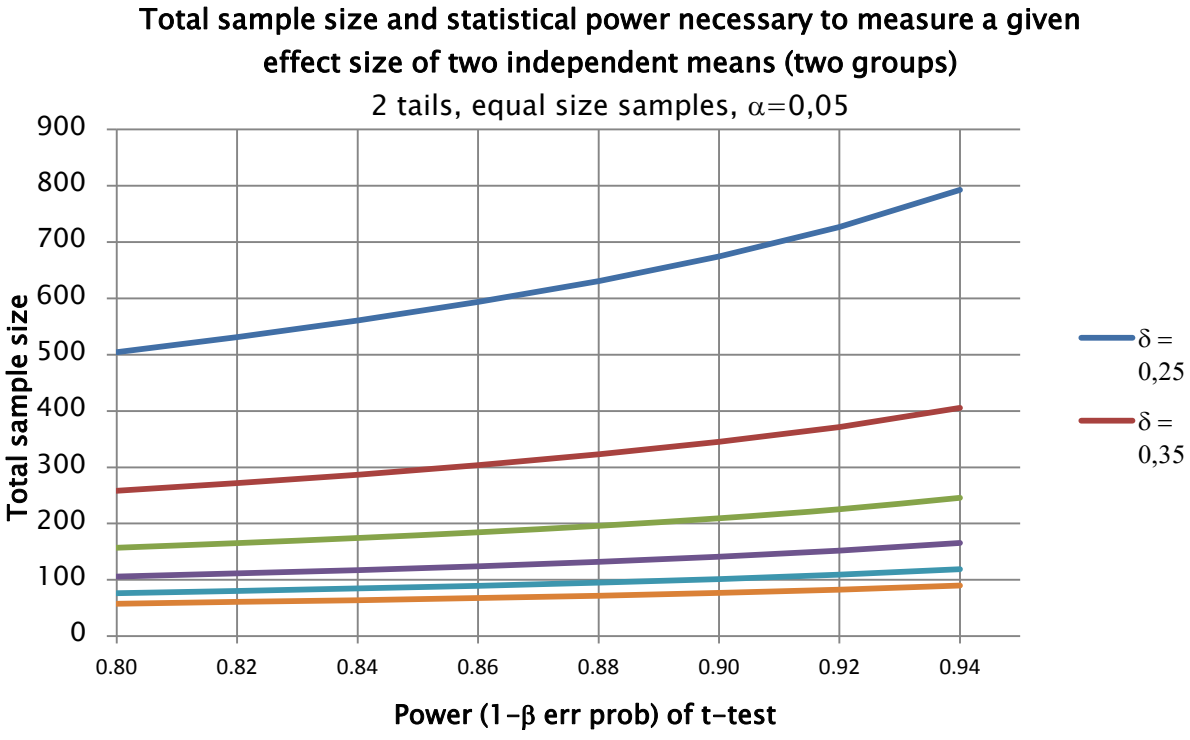
- Assessment instruments don't match the defined aims
- Reliability and validity of assessment instruments

How to measure

- It is difficult to isolate the impact of ICT in real educational settings
- Differences between the design and implementation
- Lack of explanation regarding results
- Relevance of findings

ICT impact in Education

2. Impact evaluation



ICT impact in Education

3. Scaling-up

- **It has not been studied in depth** : tendency to try and repeat what worked locally, everywhere

- Dimensions of scalability:
  - **Depth** (changes needed in classroom practice)
  - **Sustainability** (how to maintain these changes over time and under what conditions)
  - **Spread** (diffusion of the innovation to large numbers of classrooms and schools)
  - **Shift in reform ownership** (school's adoption of the programme)

ICT impact in Education

4. Cost-effectiveness and return on investment

- Very few rigorous, quantitative studies of the real cost of ICT in education have been conducted

- The required investment in ICT cannot be easily:
  - Calculated
  - Compared between different countries and schools

- Even less is known about the cost-efficiency of ICT, particularly in developing countries

Frameworks to study ICT in education

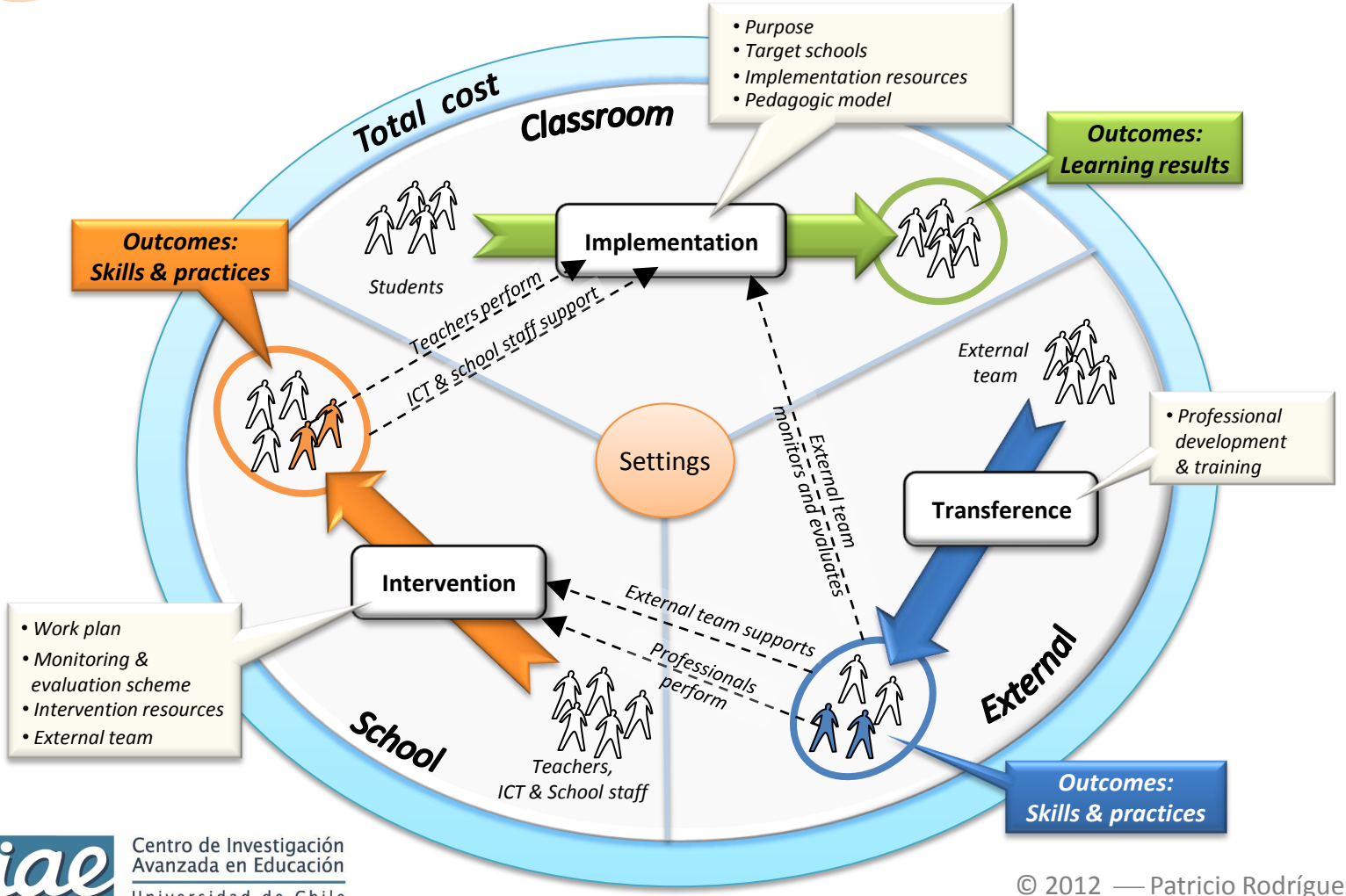
- **ICT for Education (ICT4E) programme:**
  - What we understand by an educational programme based on ICT?
  - How and why a Technology Enhanced Learning environment works?
  - What do teachers and students need to perform new teaching and learning practices?
  - How can we calculate the total cost to compare it with other educational programmes?

Framework proposals

- **Evolutionary Development Model:**
  - How can we design, implement and evaluate ICT4E programmes?
  - How can ensure the effectiveness of the ICT4E programmes before performing expensive summative evaluations?

ICT4E programme

The model



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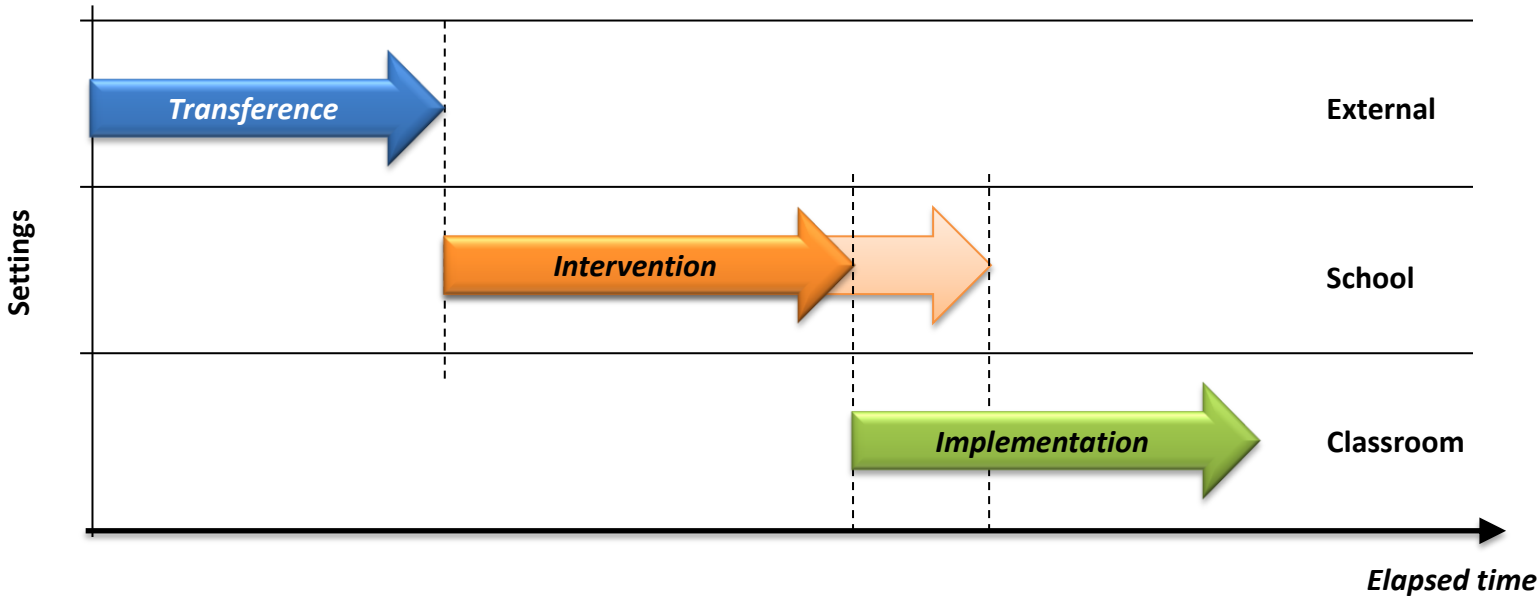
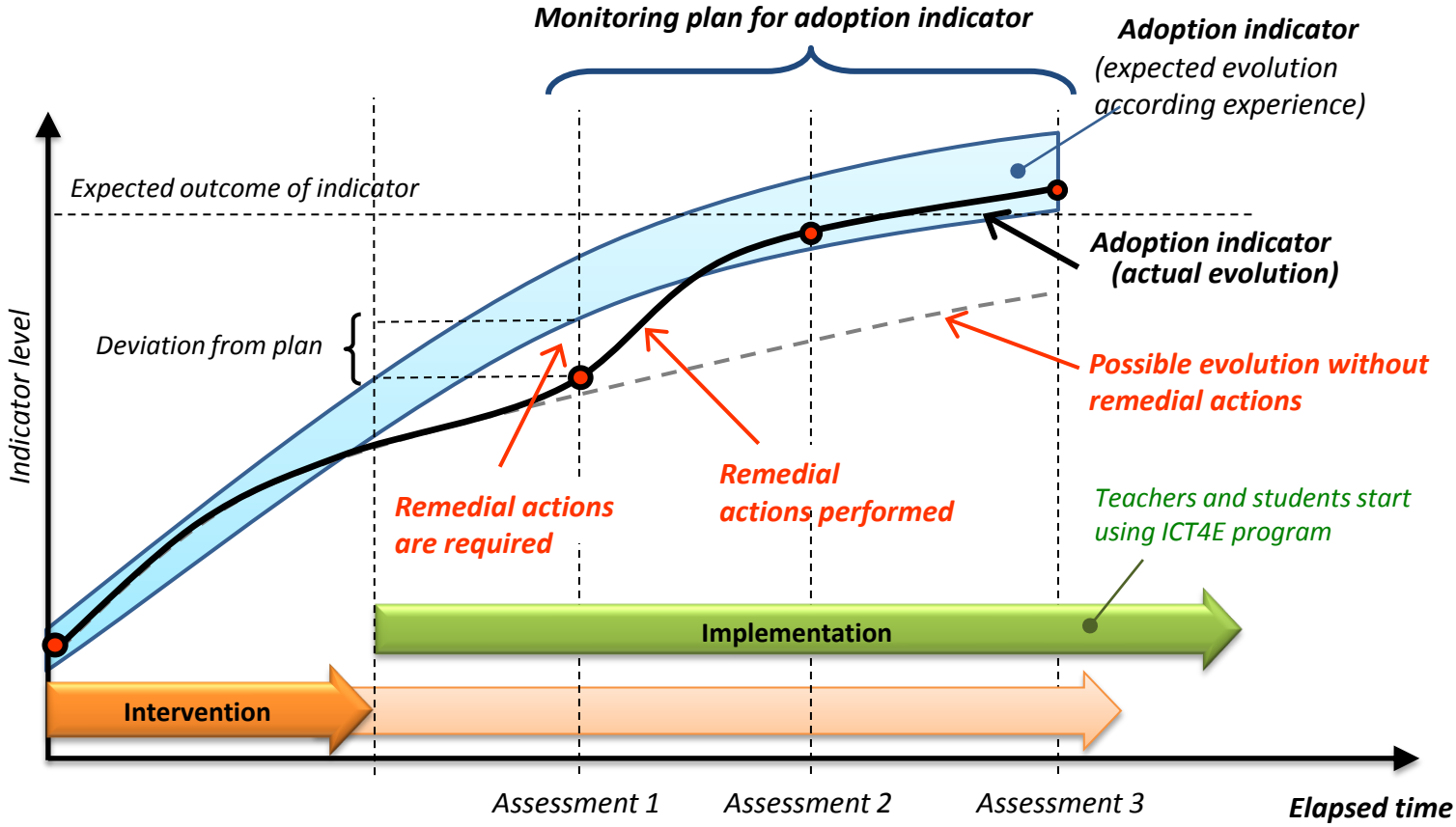
ICT4E programme

Activities timeline



ICT4E programme

Monitoring and evaluation scheme (M+E)



Evolutionary Development Model

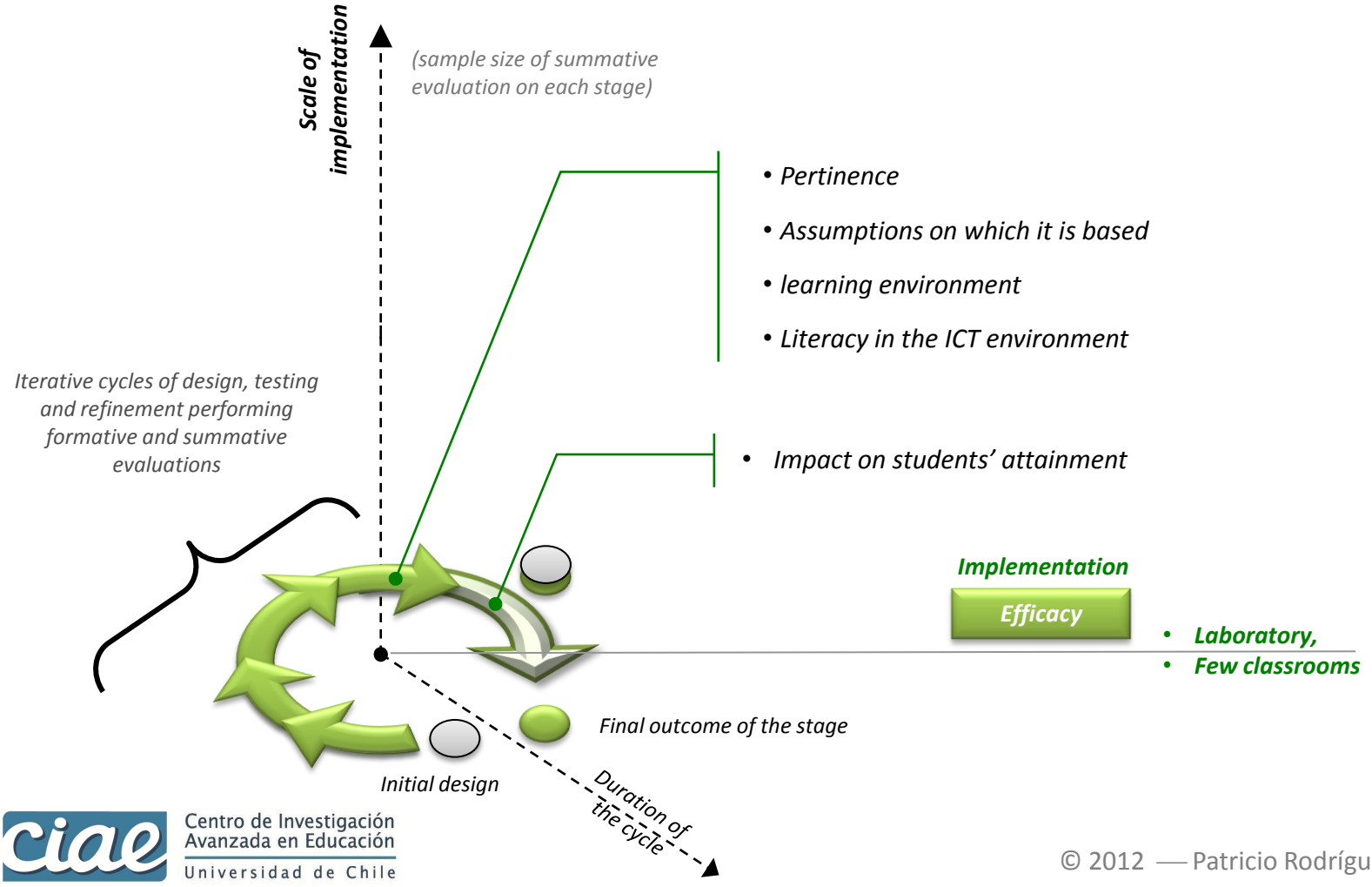
Description

- Decomposes and studies the problem of designing, implementing, evaluating and scaling-up ICT4E programmes in 3 stages:
  - **Efficacy**
  - **Effectiveness**
  - **Efficiency**

- Ensure the effectiveness of the ICT4E programs **before** performing expensive summative evaluations.

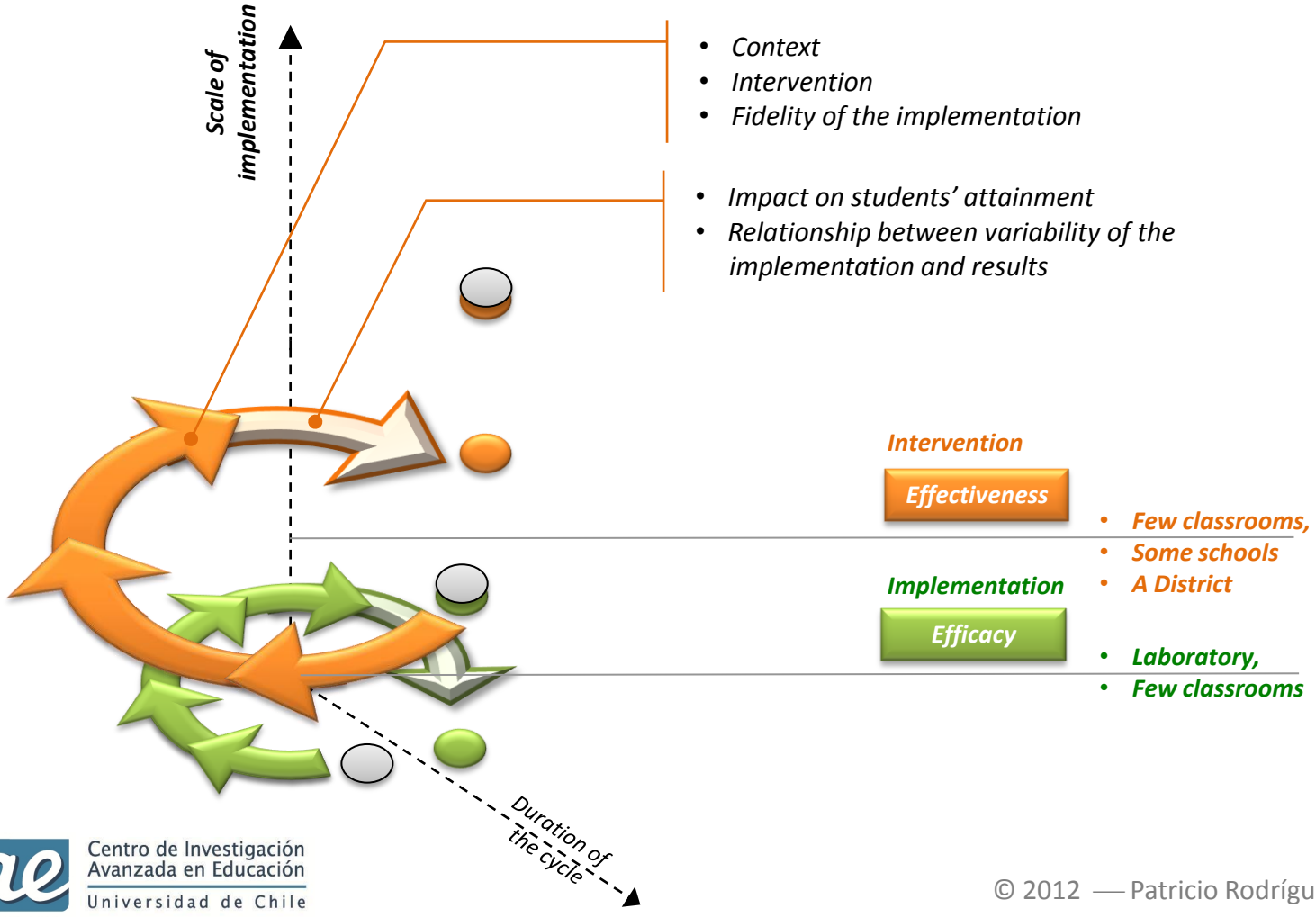
Evolutionary Development Model

Efficacy → Implementation



Evolutionary Development Model

Effectiveness → Intervention



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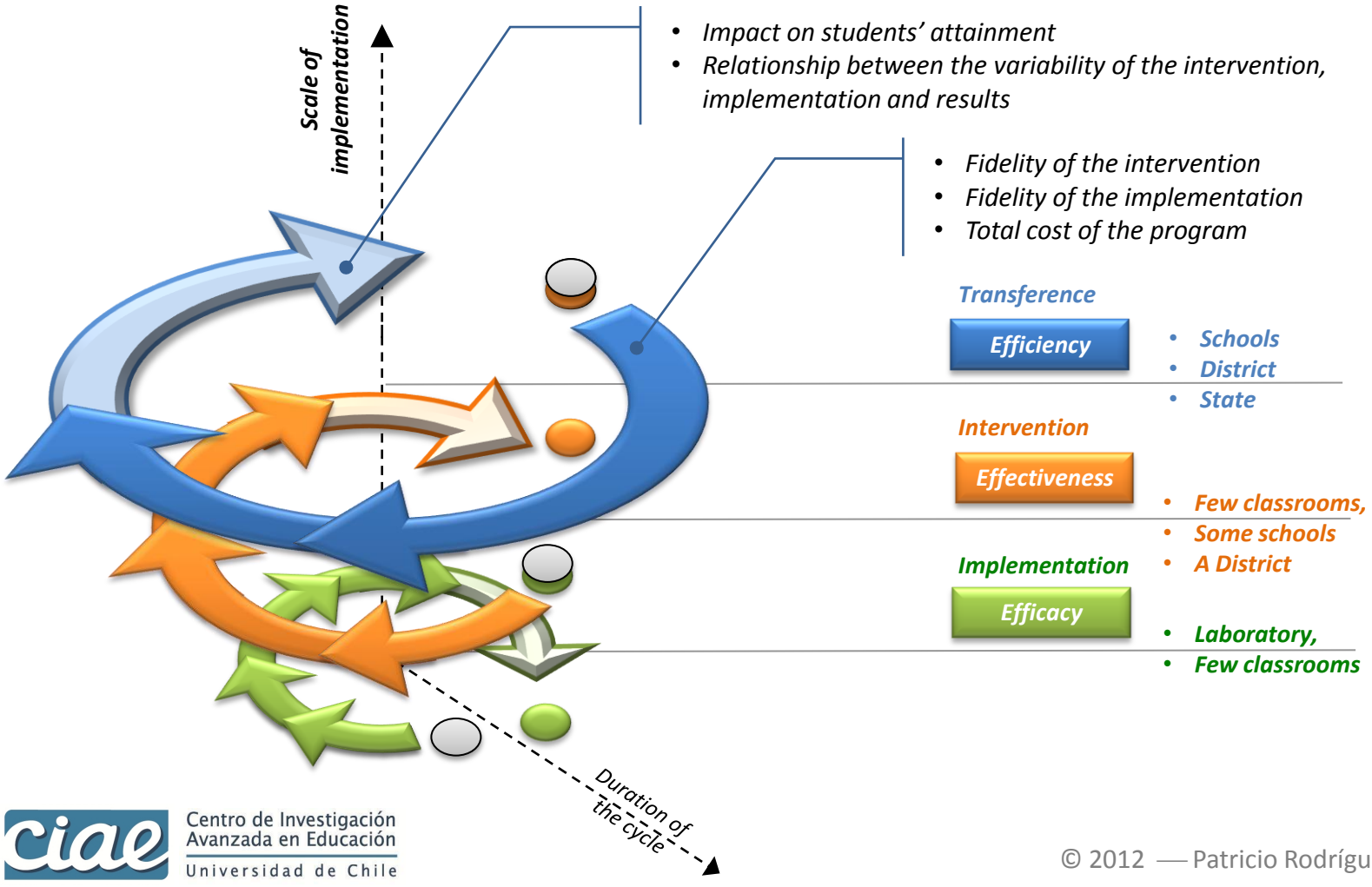
Evolutionary Development Model

Efficiency → Transference



- *Impact on students' attainment*
- *Relationship between the variability of the intervention, implementation and results*

- *Fidelity of the intervention*
- *Fidelity of the implementation*
- *Total cost of the program*

Transference

Efficiency

- *Schools*
- *District*
- *State*

Intervention

Effectiveness

- *Few classrooms,*
- *Some schools*
- *A District*

Implementation

Efficacy

- *Laboratory,*
- *Few classrooms*

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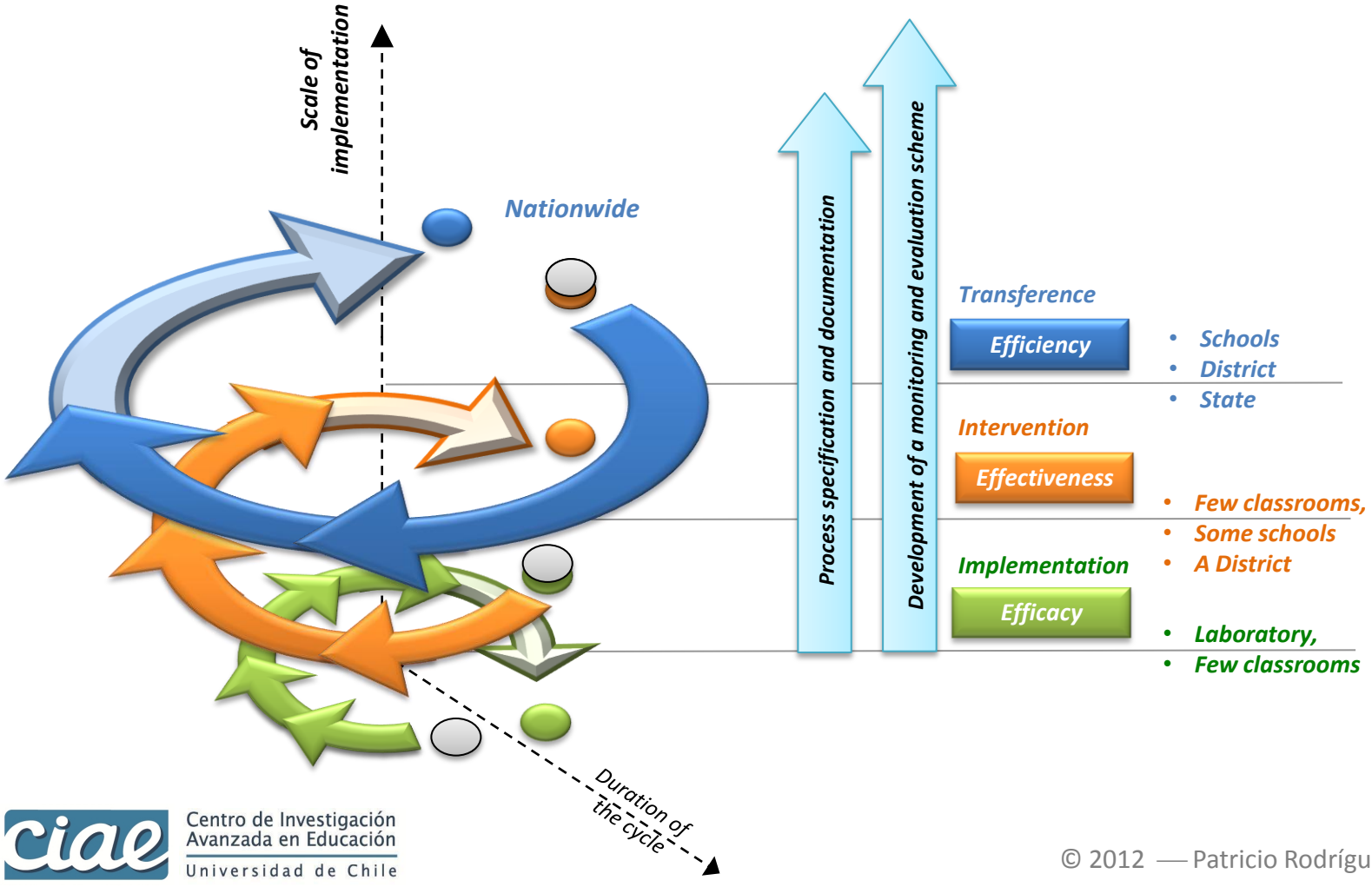
Evolutionary Development Model

Result: an ICT4E programme



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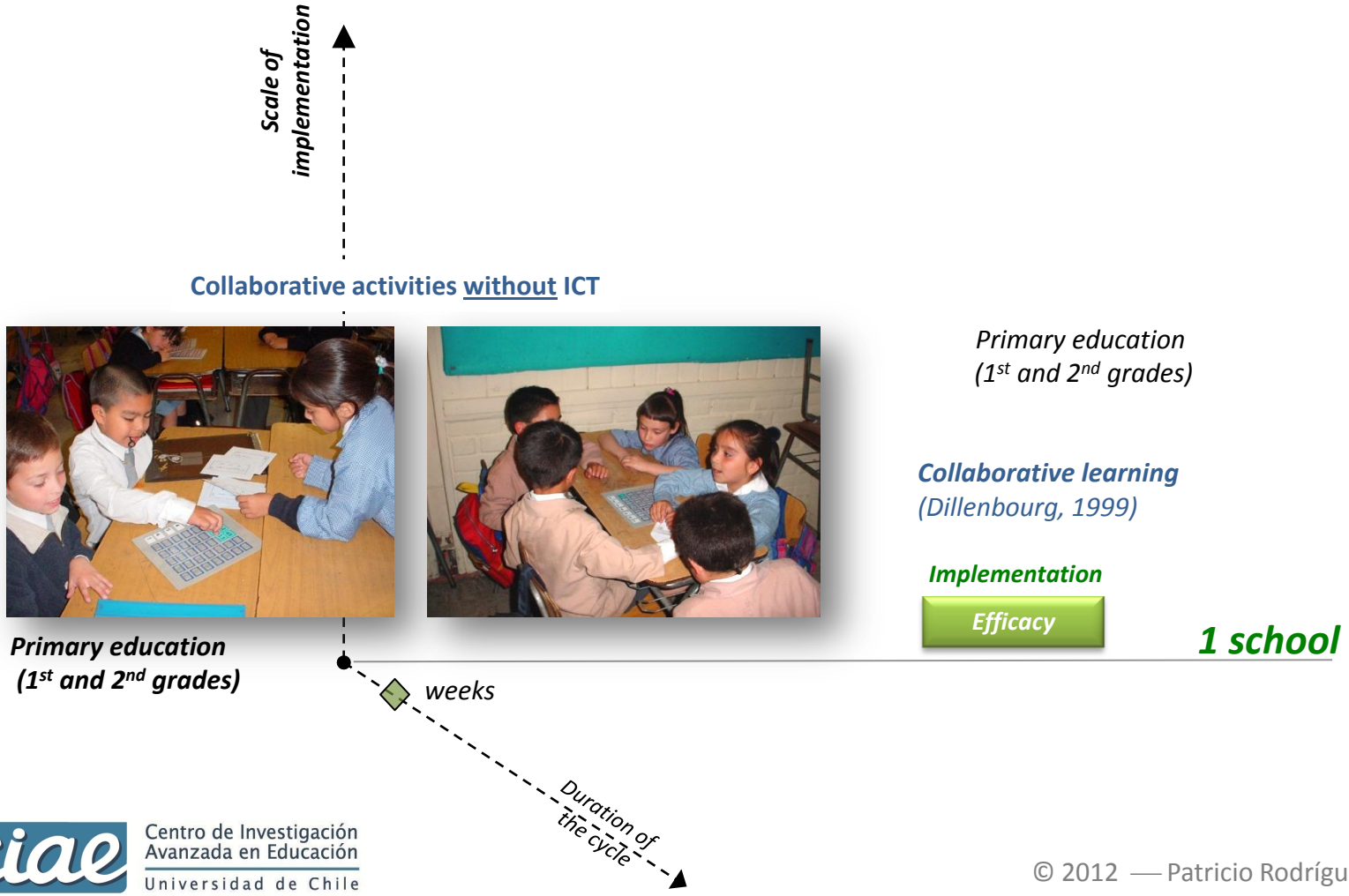
Evolutionary Development Model

An example: *efficacy*



Evolutionary Development Model

An example: *efficacy*

Scale of implementation

Collaborative activities supported with ICT

Primary education (1st and 2nd grades)

Mobile Computer supported Collaborative learning
(Zurita & Nussbaum, 2007)

Implementation

Efficacy

1 school

weeks

Duration of the cycle

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Evolutionary Development Model

An example: *efficacy*

Collaborative activities without ICT

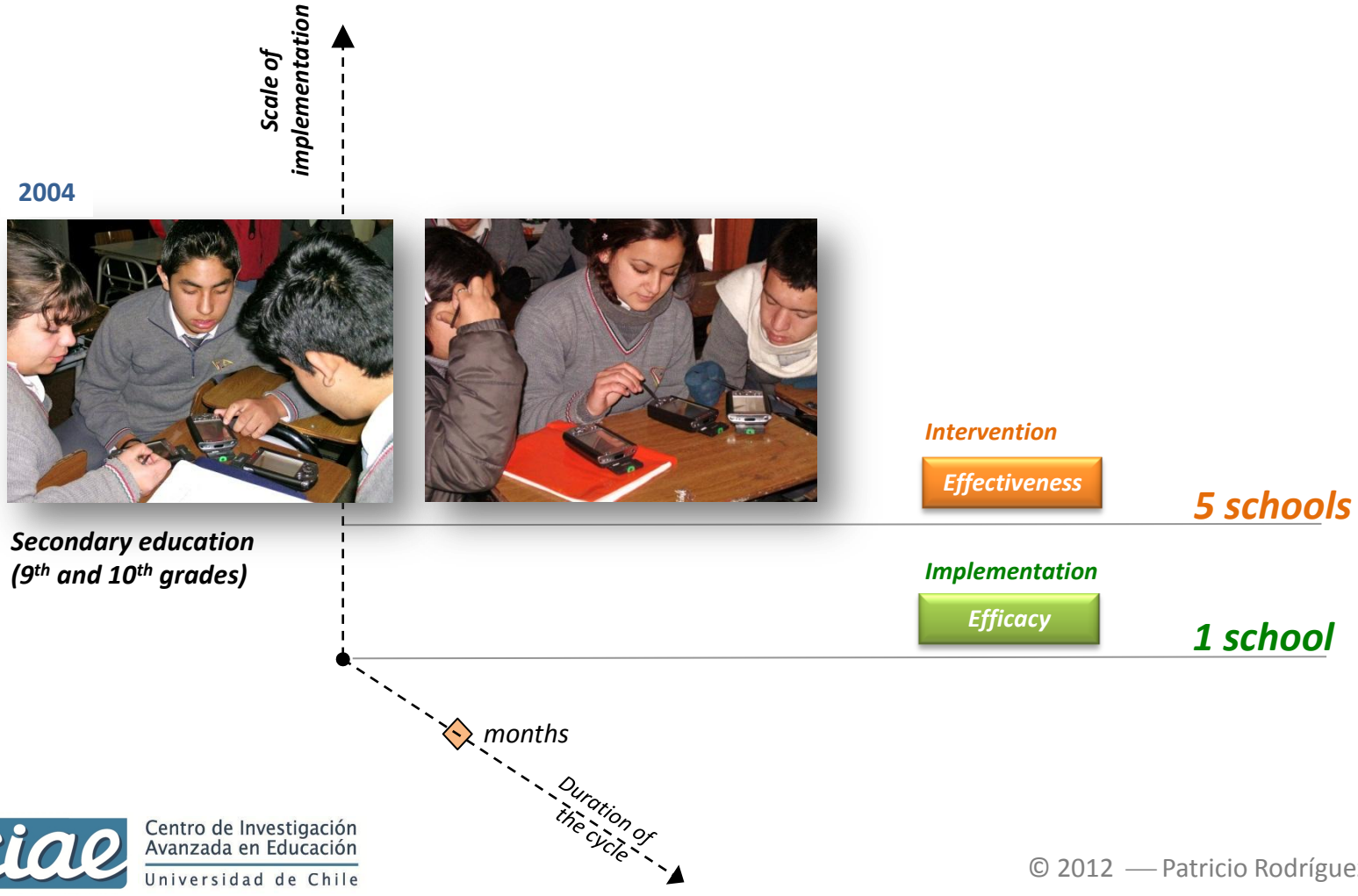
Evolutionary Development Model

An example: *efficacy*

Collaborative activities supported with ICT

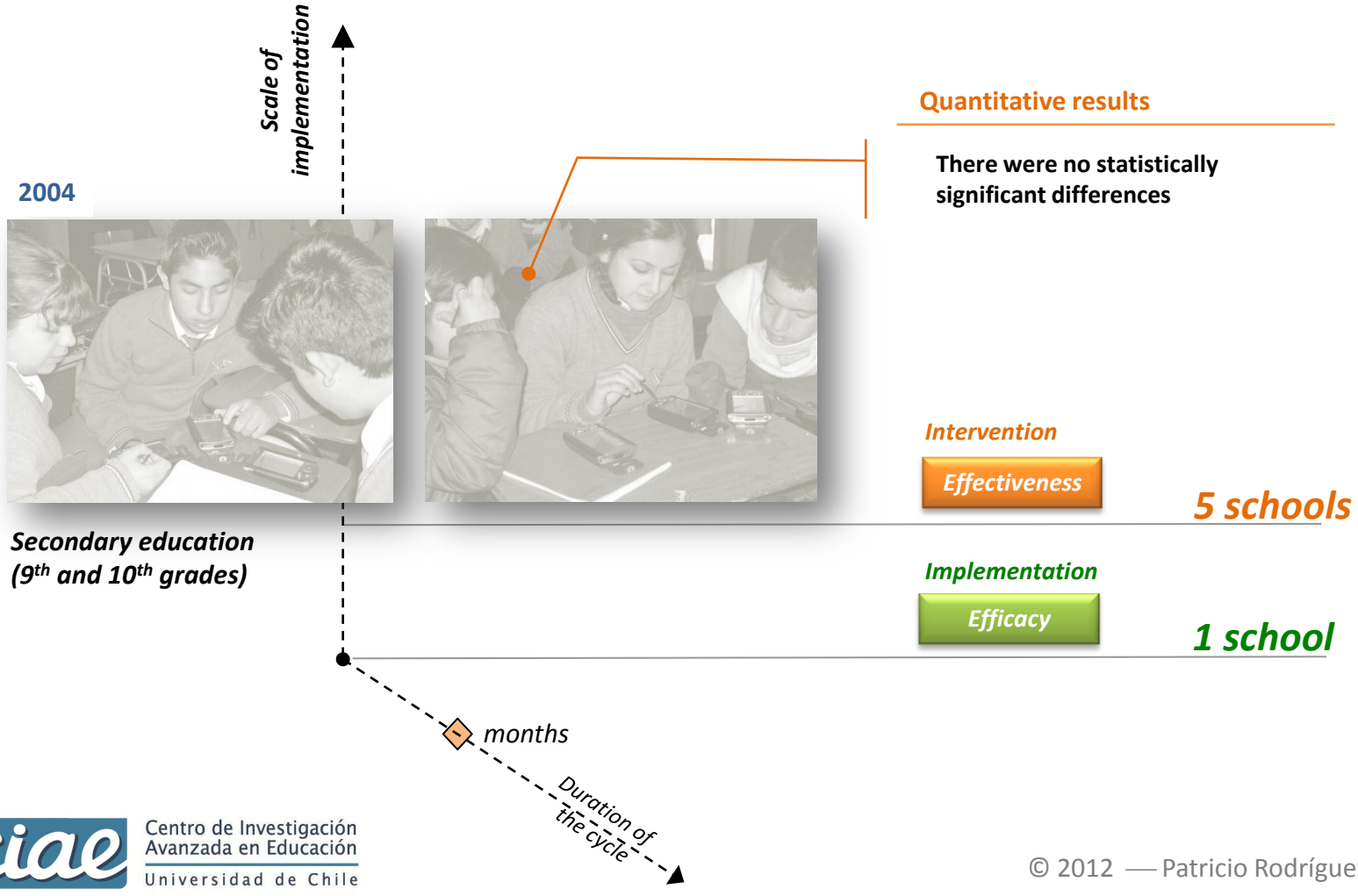
Evolutionary Development Model

An example: *effectiveness*



Evolutionary Development Model

An example: *effectiveness*



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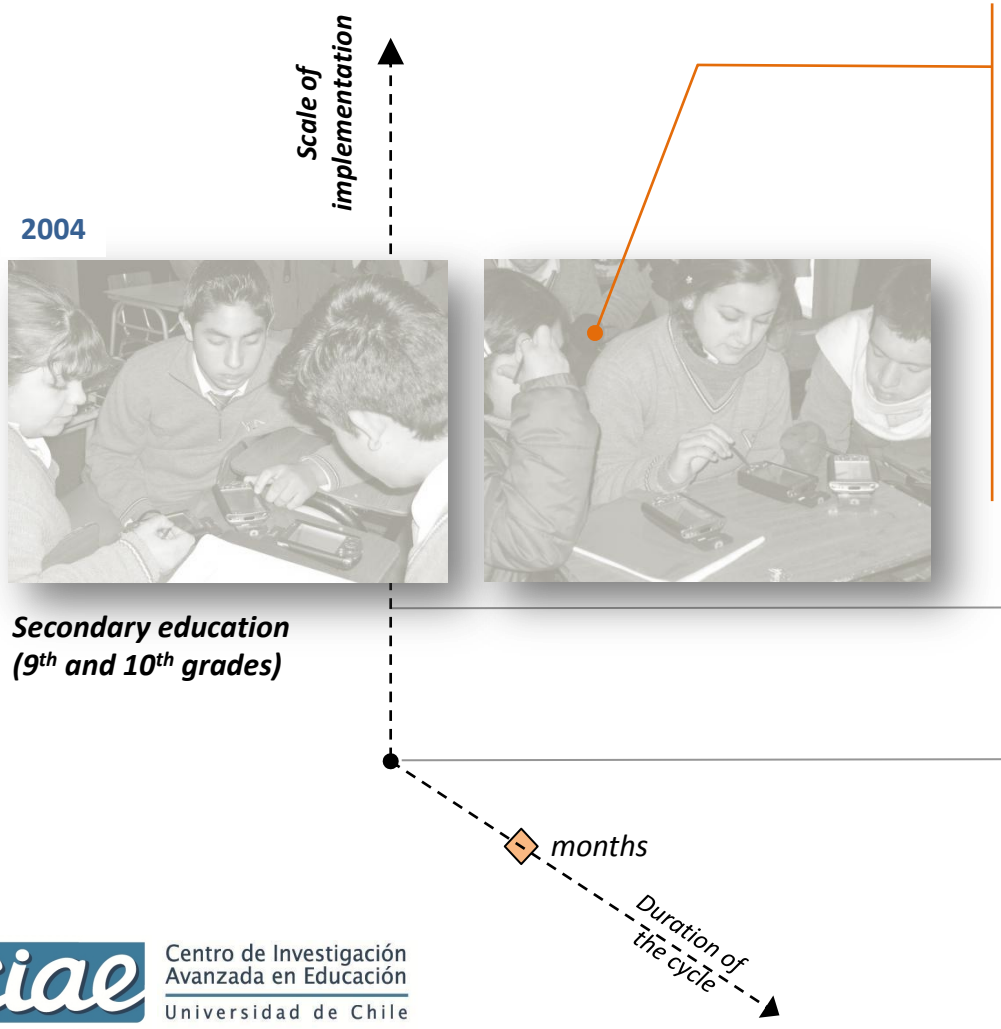
Evolutionary Development Model

An example: *effectiveness*



Qualitative results

Educational contexts (inherent flaws)
- Planning and use of class time
- Communication between teachers
- Mastery of subject

Teaching orientation: Changing roles is not automatic

Technical problems: connectivity and usability, logistics

Research overhead: constant external assessments overburn teachers

Intervention

Effectiveness — ***5 schools***

Implementation

Efficacy — ***1 school***

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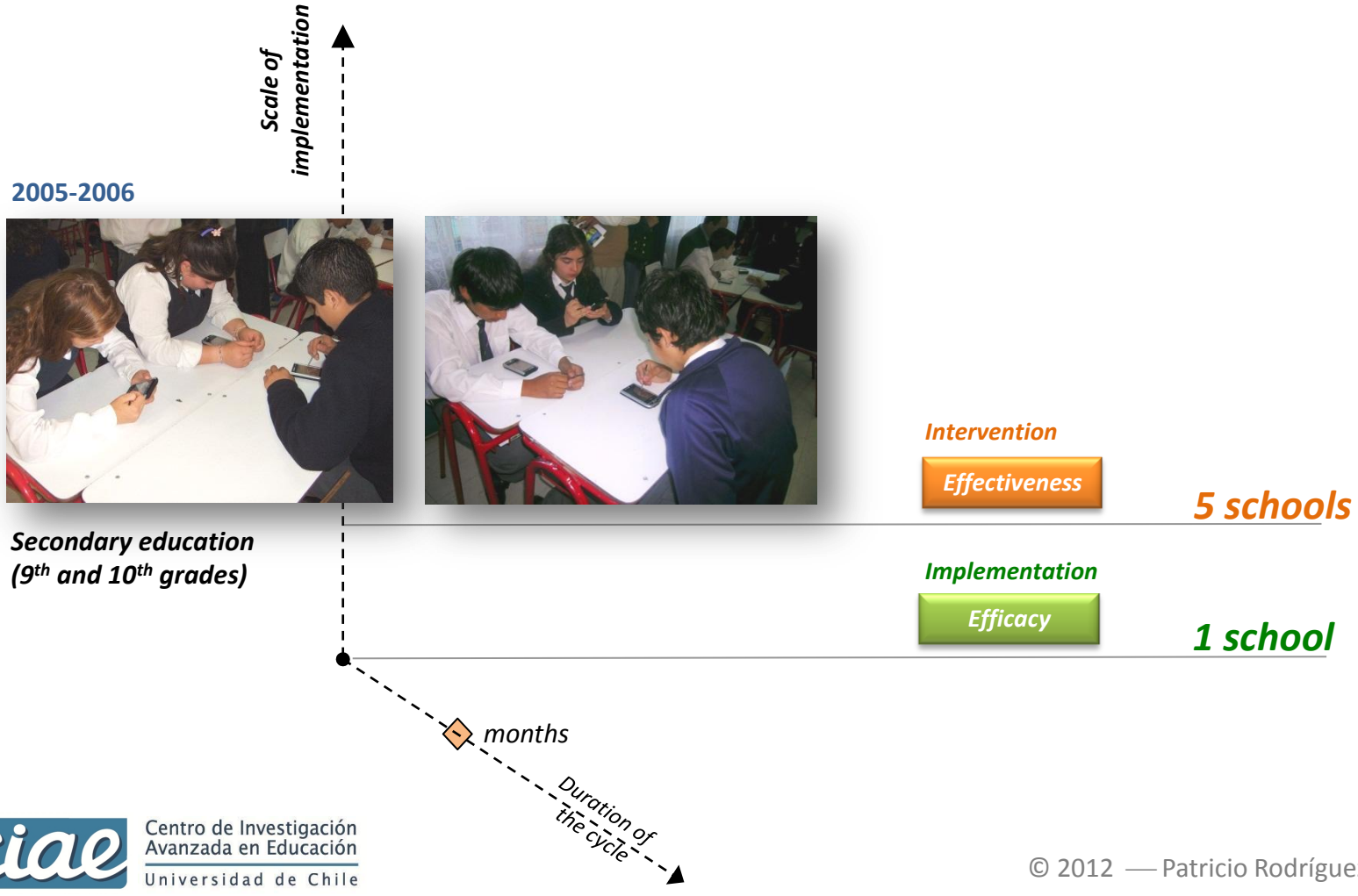
Evolutionary Development Model

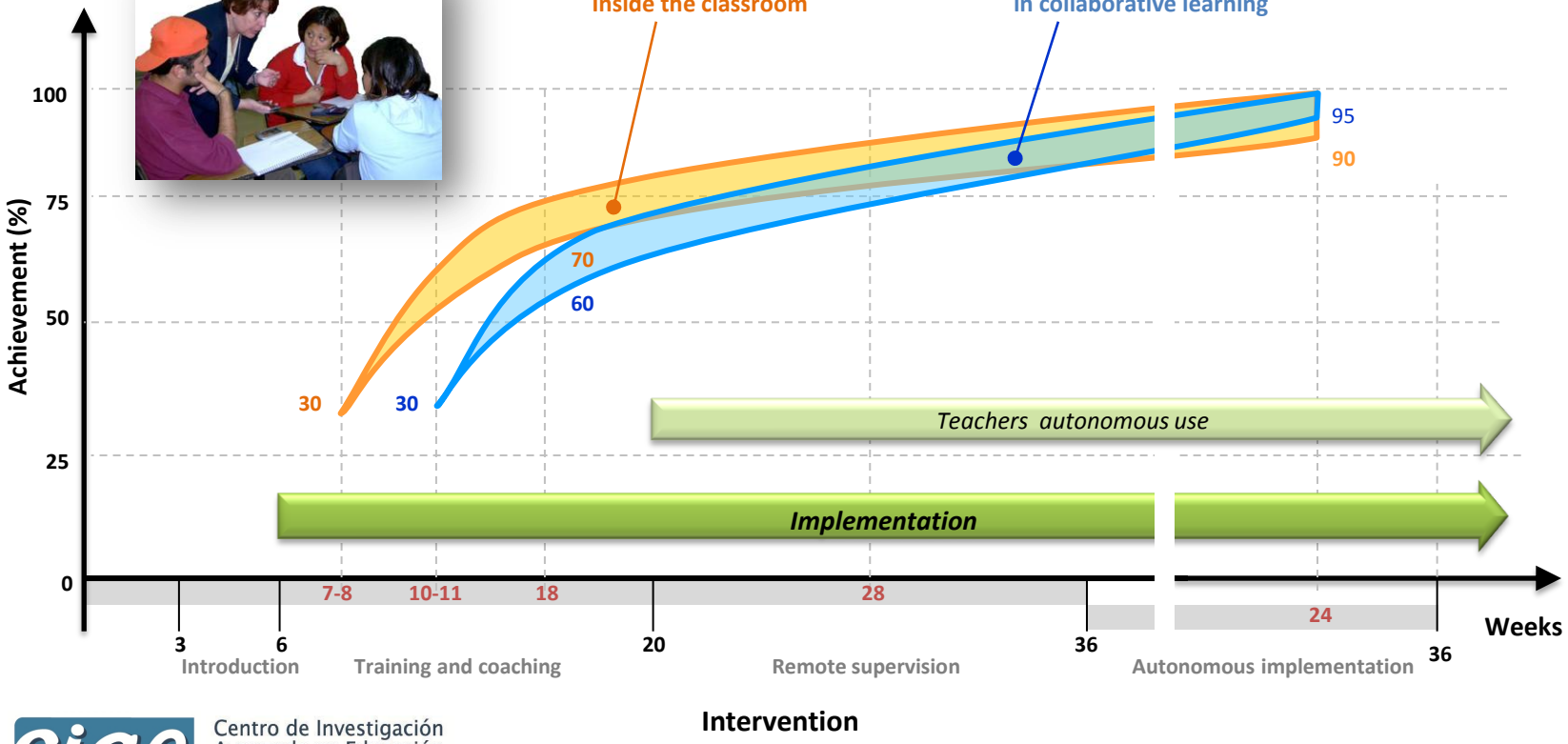
An example: *effectiveness*



Evolutionary Development Model

An example: *effectiveness*

Monitoring and evaluation scheme (M+E)



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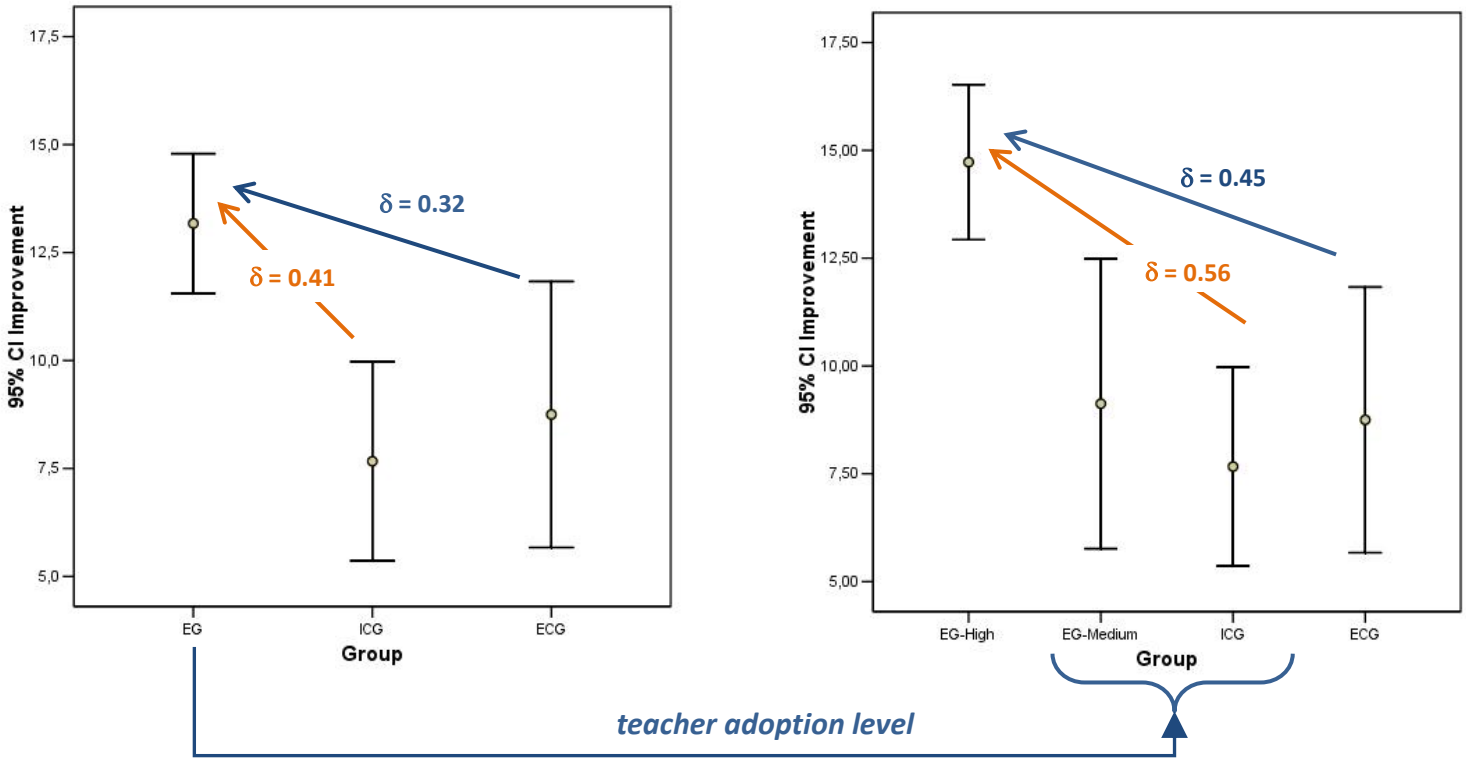
Evolutionary Development Model

An example: *effectiveness*

Students' attainment in Physics (10th grade) 2005-2006



(Rodríguez et al. 2010)

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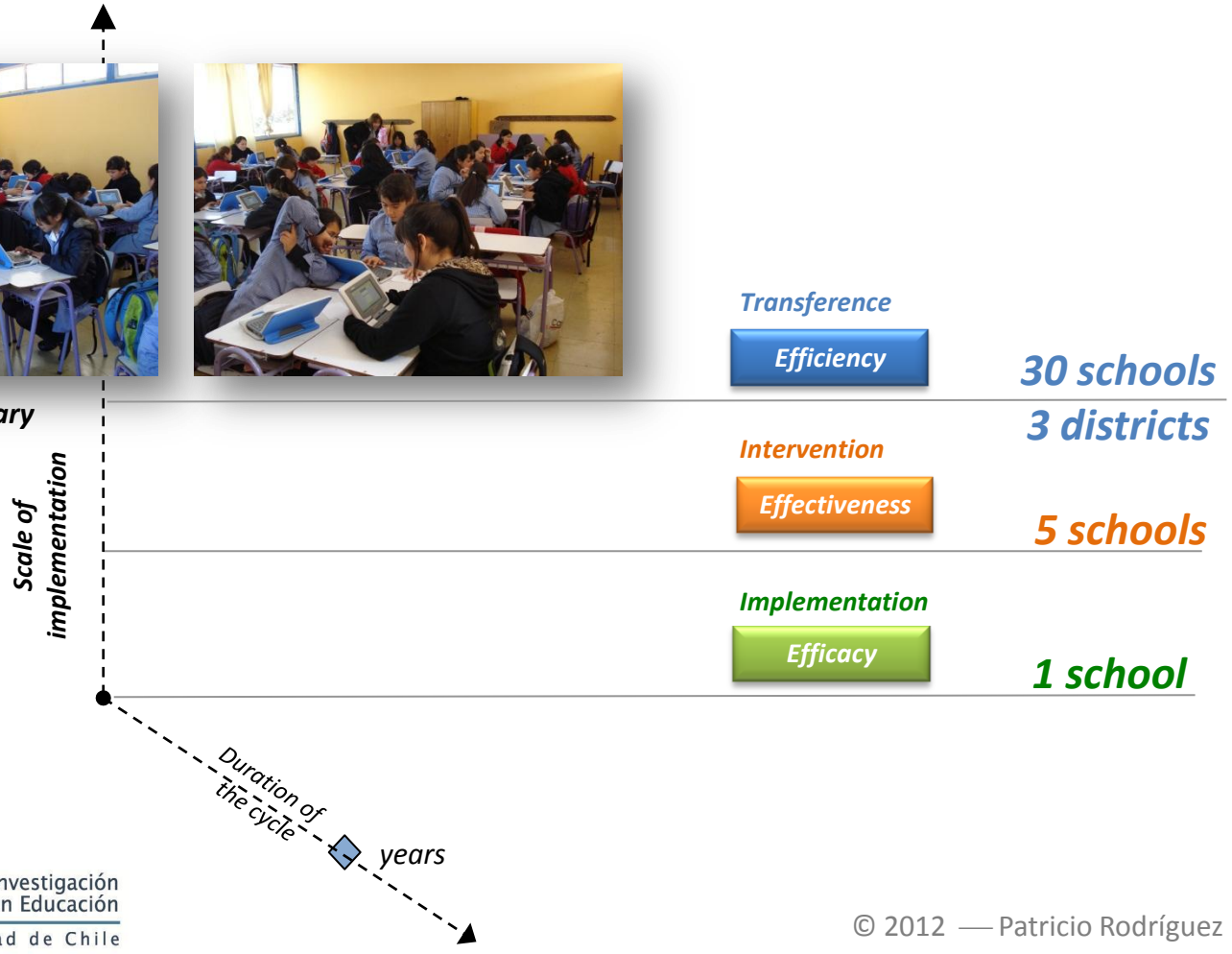
Evolutionary Development Model

An example: *efficiency*

2007

Primary and secondary education



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Evolutionary Development Model

An example: *efficiency*

2008

δ MM 0.52 – 0.66

Primary and secondary education

Transference

Efficiency

30 schools

3 districts

Intervention

Effectiveness

5 schools

Implementation

Efficacy

1 school

Duration of the cycle

years

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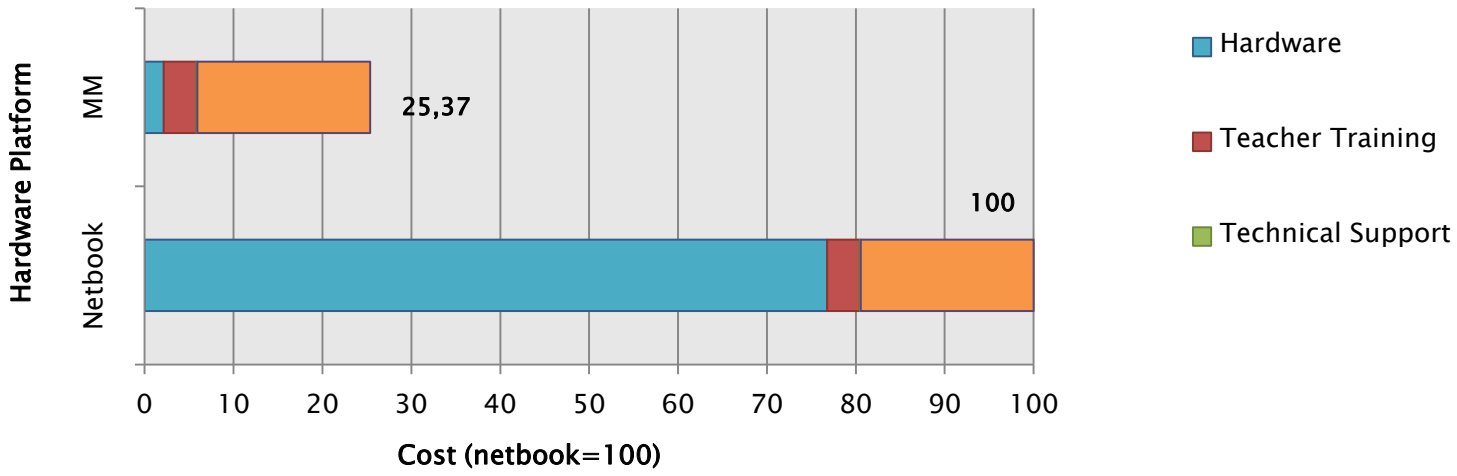
Evolutionary Development Model

An example: *efficiency*

Comparative costs of MCSCL using Netbooks vs Multiple mice



Implications for policy making

Applications

- **ICT4E programme:**
  - Calculus of total cost and return of investment
  - Analysis of economic feasibility and cost-effectiveness
  - Specification of ICT projects for public funding
  - Assessment according to a standard of evaluation: Enlaces (Chilean Educational technology office)
  - Differentiate impact depending on adjustment to the definition

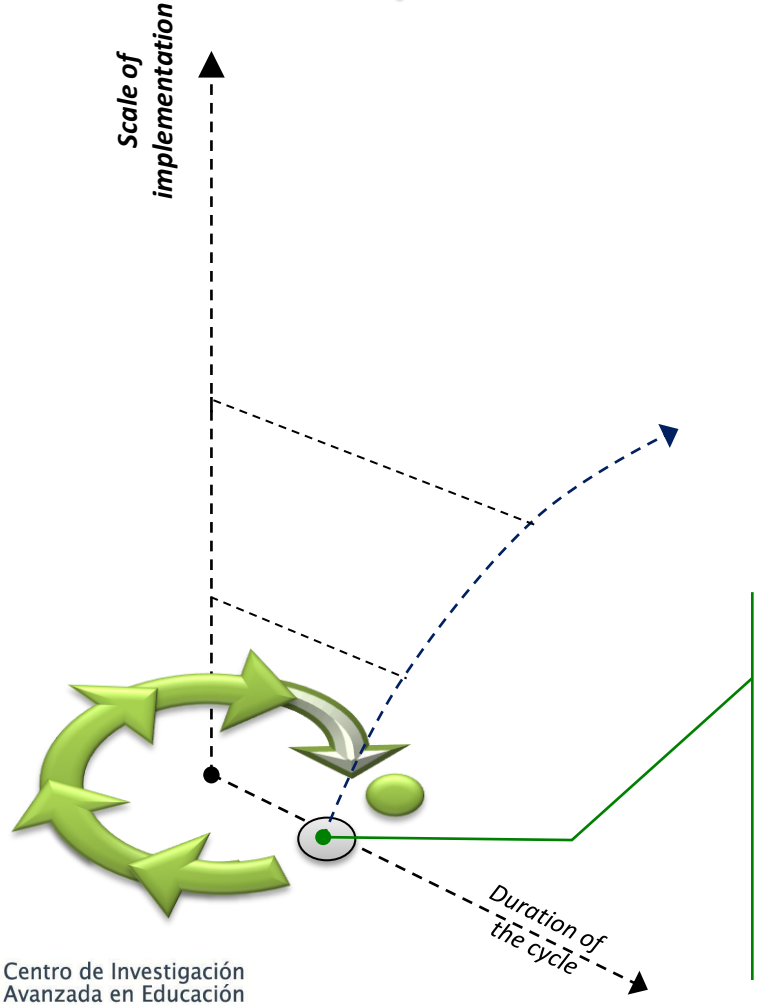
Implications for policy making

Applications

- **Evolutionary Development Model:**
  - **Roadmap** to create programmes both technically and financially feasible
  - Works from **specific needs** and realities of the schools
  - Can be used as base of a **system of grants** for each stage of the model:
    - Projects at the same stage are compared in terms of **cost-effectiveness** to determine if they will receive further funding
    - Rigorous evaluation standards for summative evaluations
  - **Learn from failure**

Implications for policy making

How can policies benefit from this?



From where to start?

What do we need and what are our chances of being successful?

- School problems driven
- Alignment with current policies
- Innovators vs. followers
- Expectations about impact and costs

Diversification vs Intensification:

- Subjects, levels
- Beneficiary population
- Innovativeness profiles

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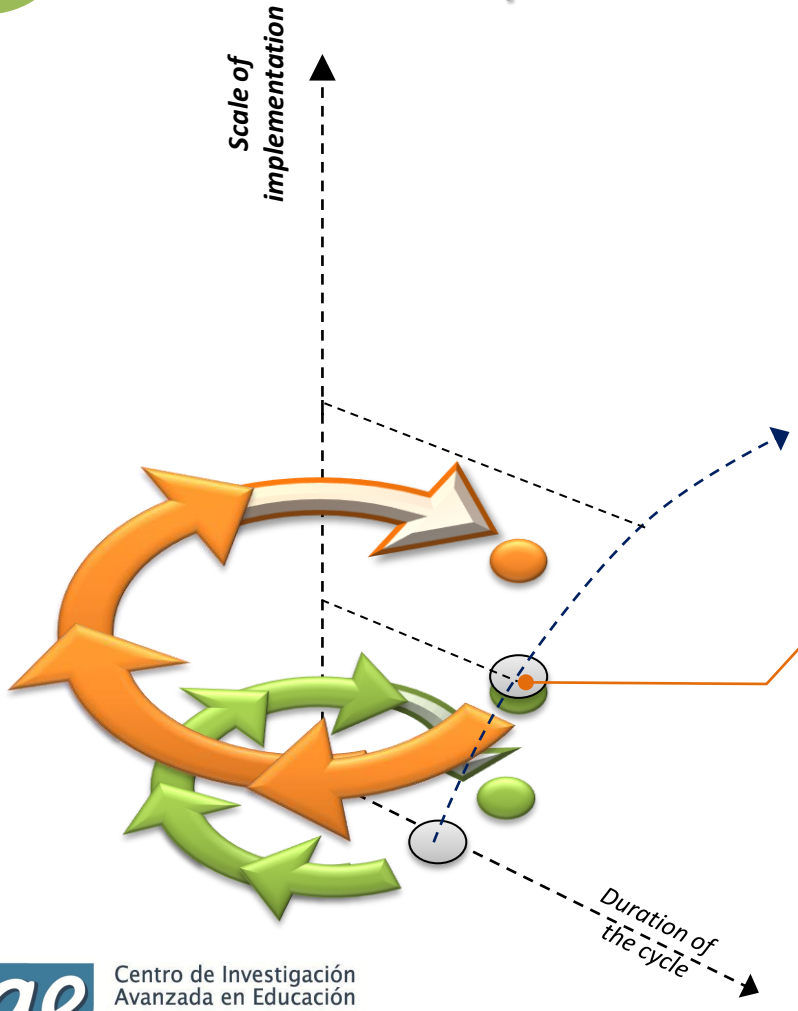
Implications for policy making

How can policies benefit from this?



Which projects should continue?

Comparing ICT4E vs "traditional" initiatives

- Single or different tracks?

Selection criteria

- Cost-effectiveness of intervention including Monitoring and Evaluation
- Portfolio of projects:
  - According to risk
  - Innovativeness profiles
  - Infrastructure required
  - Sustainability
  - Scalability

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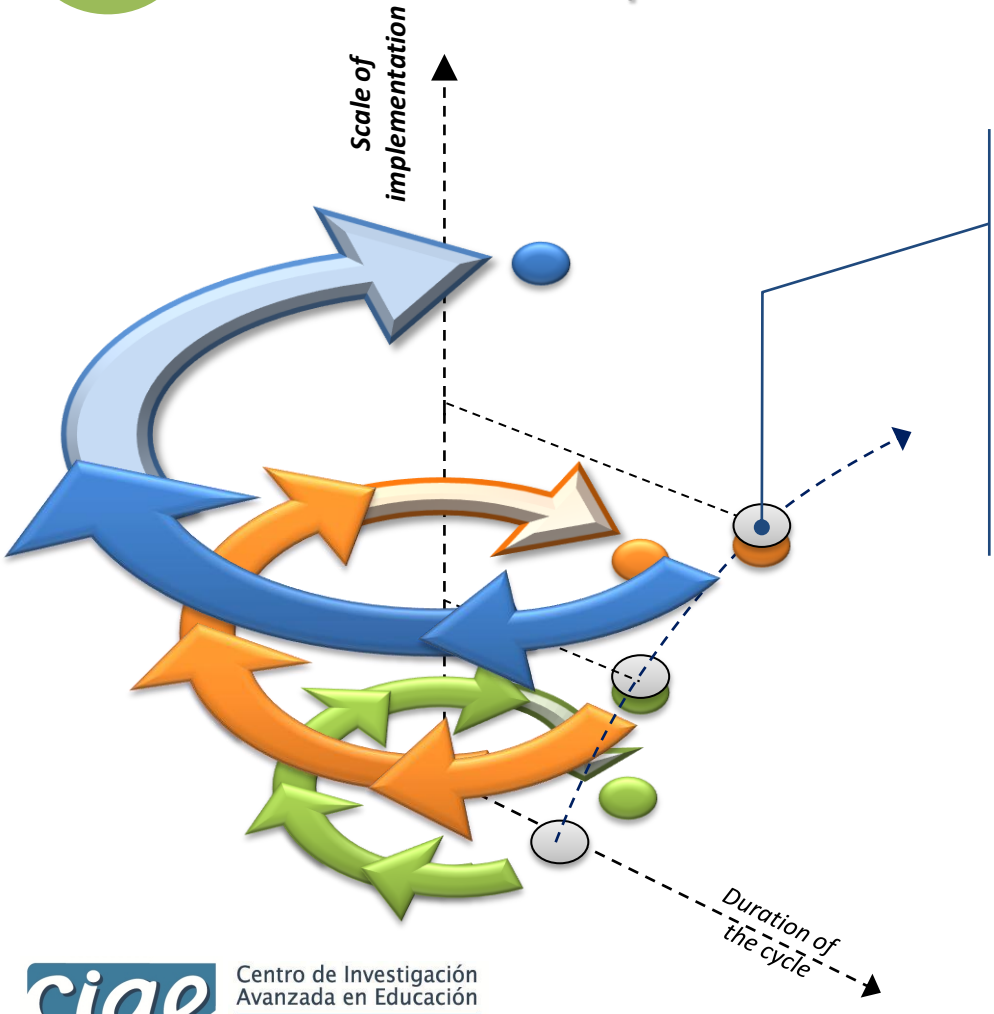
Implications for policy making

How can policies benefit from this?



Transference to the educational system

Delivery and funding models

- Government purchase and distribute vs subsides or private investment

Certification and quality assurance:

- Optimal relationship between cost and effectiveness across time
- Are desired effect achieved?

Technological issues:

- Obsolescence
- Emerging technologies (e.g. e-readers)

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Implications for policy making

Further Research questions

- What do happen if we remove the word “ICT” from these frameworks?
  - What is the relative impact between ICT4E and more “traditional” educational programmes?
  - There are some differences between the effectiveness of the programmes depending on specifics characteristics?
- How can policy-makers choose between educational programmes?

Thank you!

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