DOS MIRADAS TEORICAS DE LA EVALUACION FORMATIVA EN EL CASO DEL APRENDIZAJE POR INDAGACION:

CONTRASTE ENTRE LA VISION SOCIO-CONSTRUCTIVISTA Y LA VISION SOCIO-CULTURAL

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Propósito

A partir de las visiones individualista y socio-cultural del aprendizaje, dentro del contexto del aprendizaje por indagación, contrastar :

- Una perspectiva de evaluación formativa que centra la atención en el aprendizaje individual

con

- una que centra la atención en el proceso de aprendizaje individual, grupal y colectivo.

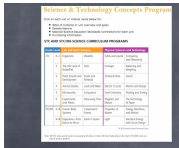
La presentación

- El contexto ECMBI
- La evaluación formativa o para el aprendizaje dentro del aprendizaje basado en indagación
  - una visión individualista
  - una visión socio-cultural
- Conclusiones

El contexto de la Enseñanza de las Ciencias y las Matemáticas Basada en la Indagación

ECMBI- ECBI (IBSME - IBSE)

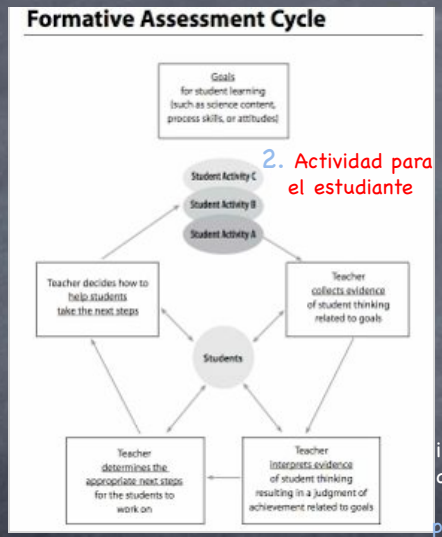
Redes ECMBI en el mundo



IndagaLa
SINUS programme
Fibonacci / http://www.fibonacci-project.eu/
Science on Stage (SonSEu)
La main a la Pate /http://www.lamap.fr/international/countrypartnersmap
Pollen / http://www.pollen-europa.net/?
Primas
http://www.primas-project.eu/artikel/en/1298/Partners/view.do
SECURE project
http://www.secure-project.eu/

Evaluación para el aprendizaje o evaluación formativa

Una visión individualista



1. Objetivos para el aprendizaje del estudiante: habilidades, actitudes, contenido científico (conceptos)
2. Actividad para el estudiante
3. El profesor recolecta información que evidencia la forma de pensar del estudiante en relación a los objetivos de aprendizaje
4. El profesor interpreta la evidencia de la forma de pensar del estudiante y produce un juicio sobre el desempeño del estudiante en relación a los objetivos de aprendizaje
5. El profesor determina los pasos apropiados a seguir para el trabajo del estudiante
6. El profesor decide como ayudar a los estudiantes a seguir el siguiente paso

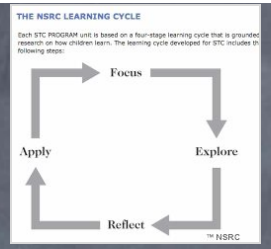
Supuestos socio-constructivistas

- Radford
- el conocimiento no es recibido pasivamente por el sujeto sino construido por éste.
- la función de la cognición es adaptativa y sirve a la organización de la experiencia del mundo, no al descubrimiento de una realidad ontológica (ver von Glasersfeld, 1995, p. 18).

Supuestos socio-constructivistas

El individuo aprende

- En un proceso activo de construcción de su propio conocimiento
- Cuando sus estructuras mentales se modifican (cambio conceptual)
- Al interactuar con el medio y los otros



™ NSRC

- **Focus**

Students and teachers focus on what students already know about a topic and develop new goals for learning through brainstorming and discussion

- **Explore**

Students engage in hands-on exploration that builds upon their previous knowledge

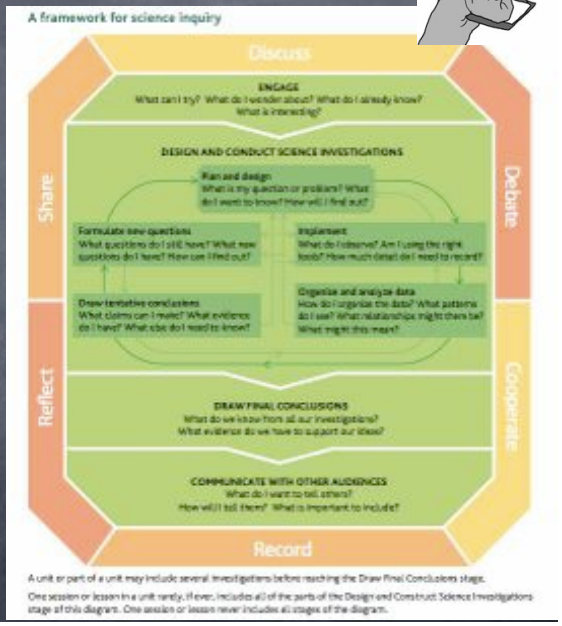
- **Reflect**

Students analyze their observations and data, review their original ideas related to the phenomena investigated, and provide evidence for their explanations of what they have observed

- **Apply**

Students apply their recently developed understanding of science concepts to new situations.

Worth, K., Duque, M., & Saltiel, E. (2009). Designing and Implementing Inquiry-Based Science Units. In L. m. à. l. pâte (Eds.) Available from http://www.pollen-europa.net/?page=ietK5bjge5o%3D



Supuestos socio-constructivistas

Existencia de concepciones erróneas, teorías ingenuas, estructuras mentales,

- Independientes de la cultura y edad
- Hacen parte de la evolución biológica del individuo
- Se modifican cuando el individuo actúa en el medio de acuerdo con sus ideas y no sucede lo que esperaba

Piaget, J. (2004). *The Language and Thought of the Child.* London: Routledge.

Existe una actividad mental del niño que toma lugar solamente en el plano de lo verbal y que no es social.

Cada niño tiene su propio mundo de hipótesis y soluciones que nunca ha comunicado, ya sea porque está centrado en si mismo, o porque no puede expresarlas

- Piaget, (2004)
- … mental activity can take place only on the verbal plane, and in this sense they will always differ from those bearing upon toys and instruments, etc., which imply manual work or at least manipulation (p. 79).
- … this verbal activity is not social; each child carries it on by himself. Each child has his own world of hypotheses and solutions which he has never communicated to anyone, either because of his ego-centrism, or for lack of the means of expression –which comes to the same thing, if […] language is moulded on habits of thought. (p. 79)

Pellegrino, Chudowsky, & Glaser, (2002)

Some types of knowledge are universally acquired in the course of normal development, while other types are learned only with intervention of deliberate teaching (which includes teaching by any means, such as apprenticeship, formal school, or self-study). For example, all normal children learn to walk whether or not their caretakers make any special efforts to teach them to do so, but most do not learn to ride a bicycle or play the piano without intervention.

> Thus in mathematics, the fundamentals of ordinality and cardinality appear to develop in all normal human infants without instruction. In contrast, however, such concepts as mathematical notation, algebra, and Cartesian graphing representations must be taught. (p. 29)

Sfard, (1998)

- Reconoce en educación matemática diferentes conceptos y autores que han tratado el tema de las concepciones erróneas
  - Misconceptions (Smith, diSessa, y Roschelle 1993)
  - Faulty mental schemes or tacit models (Dreyfus, 1992; Fischbein, 1989; Hershkowitz, 1989)
  - Flawed concept images (Tall y Vinner, 1981; Vinner, 1991)
  - Buggy algorithms (Brown y Burton, 1978)

Yin, Y., Shavelson, R. J., Ayala, C. C., Ruiz-Primo, M. A., Brandon, P. R., Furtak, E. M., et al. (2008). On the Impact of Formative Assessment on Student Motivation, Achievement, and Conceptual Change. *Applied Measurement in Education, 21*(4), 335-359.

- Yin et al., (2008)
- Similar to children's misunderstanding of the shape of the planet earth and "why things sink and float, "many other misconceptions are deeply rooted in everyday experiences, widely across different subject domains, among people of different ages, across different cultures, and through the history of the development of scientifically justifiable ideas. (p.338)

Muchos niños dicen que la tierra es redonda y

La perspectiva individualista

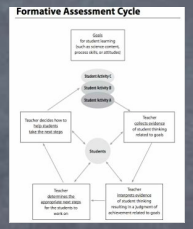
también afirman que tiene un principio y un final de donde la gente puede caer

Una inconsistencia lógica

Vosniadou & Brewer, (1992)

- For example, many children said that the earth is round but also stated that it has an end or edge from which people could fall. A great deal of this apparent inconsistency could be explained by assuming that the children used, in a consistent fashion, mental models of the earth other than the spherical earth model. Five alternative mental models of the earth were identified: The rectangular earth, the disc earth, the hollow sphere, and the flattened sphere. It is argued that these models are constrained by certain presuppositions which children form based on interpretations of their everyday experience.
- Some of these models (the rectangular earth and the disc earth) seem to be initial models children construct before they are exposed to the culturally accepted information that the earth is a sphere. (p. 535)

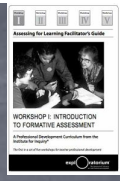
Ideas propias del estudiante



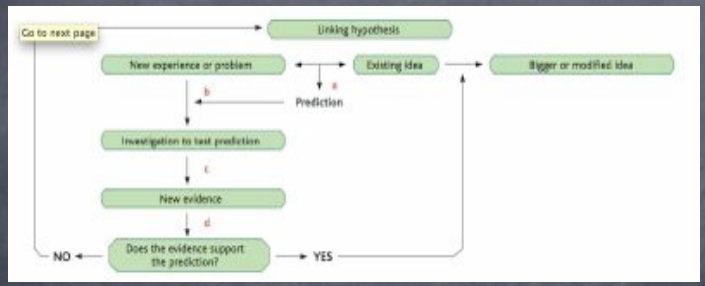
3. El profesor recolecta información que evidencia la forma de pensar del estudiante en relación a los objetivos de aprendizaje

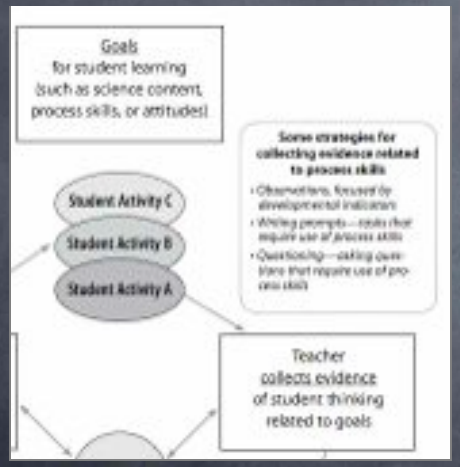
- Harlen, (2006)
- Experience and research show that merely teaching "correct" scientific ideas does not necessarily change students' understanding.
- Change is more likely to happen when students test their scientific ideas for them selves.
- Teaching through inquiry help students test their existing ideas about scientific phenomena, consider alternative ideas, and gradually develop an understanding that is more consistent with evidence and with the scientific view of how things work.
- But students often need help with this process.

Formative assessment gives teachers the means to help students express their ideas and rigorously test them (p. 10)



Saltiel, (2006) Methodological Guide. Inquiry Science Education Applying it in the Classroom





Observaciones focalizadas por indicadores de desarrollo

Guías escritas – tareas que requieren el uso de habilidades de proceso

Preguntas que requieren el uso de habilidades de proceso

Questions for Encouraging Process Skills

Process-Centered questions ask students to use their process skills when exploring. These kinds of questions can be valuable in many different classroom situations. The examples here, for instance, would be appropriate at different points for students planting and growing different kinds of seeds.

Observing
- What do you notice that is the same about these seeds?
- What differences do you notice between seeds of the same kind?
- Could you tell the difference between them with your eyes closed?
- What do you see when you look at the seeds with a magnifying glass?

Questioning
- What questions would you like to ask about seeds?
- What questions could you answer by planting and observing the seeds?

Hypothesizing
- Why do you think the seeds are not growing now?
- What do you think will make the seeds grow faster?
- Why do you think that would make them grow faster?
- Why do you think the soil will help the seeds to grow?
- Why do you think these plants are growing taller than those?
- What do you think has happened to the seeds?
- Where do you think these leaves came from?

Predicting
- What do you think the seeds will grow into?
- What do you think will happen if the seeds have soil but not water?
- What do you think will happen if we give the seeds more (or less) water/light/warmth?

Planning
- What will you need to do to find out... (if the seeds need soil to grow)?
- How will you make it a fair test (make sure it's the soil, and not something else, making the seeds grow)?
- What materials will you need?
- What will you have to look for to answer your question?

Interpreting
- Did you find any connection between... (how fast the plant grew and the amount of water/light/warmth it had)?
- Is there a connection between the size of the seed and the size of the plant?
- What made a difference in how fast the seed began to grow?
- Was soil necessary for the seeds to grow?

Communicating
- How are you going to keep track of what you did in the investigation and what happened?
- How can you explain to the others what you did and found out?
- What kind of chart/graph/drawing would be the best way to show the results?

Comparing Generic and Specific Indicators of Ideas

Generic indicators of development can be "translated" into specific indicators, as shown here.

Generic Indicators *When giving an explanation or making a prediction, do the students:*	Specific Indicators *When giving an explanation or making a prediction, did the students:*
1. Do no more than describe the situation, rather than explaining it?	1. Simply describe what happened when the drum was hit?
2. Use their own preconceived ideas, rather than scientific ones?	2. Use preconceived ideas about sound, rather than scientific ideas?
3. Refer to relevant ideas without showing how they apply?	3. Mention the relevant ideas that sound is caused by vibrations; that we hear sound when it travels to our ears?
4. Apply the relevant ideas only in situations similar to those already encountered?	4. Apply ideas about sound correctly in this situation?
5. Apply the relevant ideas in situations different from those encountered before?	5. Use these ideas in explaining sounds made by other objects and suggest that sound travels through the air to the ear?
6. Bring several relevant ideas together to give a reasoned explanation or prediction?	6. Make a connection between vibration of objects that are sources of sound and vibrations in the air reaching the ear to create the sensation of sound?

Utiliza sus ideas preconcebidas en vez de las científicas?

Utiliza sus ideas preconcebidas sobre el sonido en vez de las ideas científicas?

Evaluación para el aprendizaje o evaluación formativa

Una visión socio-cultural

El contacto del niño con la cultura y la sociedad determina el desarrollo del individuo

Supuestos socio-culturales

Radford

el saber es generado por los individuos en el curso de las prácticas sociales constituidas histórica y culturalmente.

la producción del saber no corresponde a necesidades de adaptación sino que está enmarcado por formas culturales de pensamiento imbricadas en una realidad material y simbólica, la cual provee las bases para interpretar y transformar el mundo de las personas y los conceptos que éstas forman acerca de ese mundo.

Vygotsky, L. (1986). *Thought and Language*. Cambridge: The MIT Press.

- Vygotsky, (1986)
- To summarize, the most essential feature of our hypothesis is the notion that developmental processes do not coincide with learning processes. Rather, the developmental process lags behind the learning process; this sequence then results in the zone of proximal development. (p. 35).
- The developmental uniformities established by Piaget apply to the given milieu, under the conditions of Piaget's study. They are not laws of nature, but are historically and socially determined. (p. 55)

Vygotsky, L. (1986). *Thought and Language*. Cambridge: The MIT Press.

- Vygotsky, (1986)
- We propose that an essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with peers.
- Once these processes are internalized, they become part of the child's independent developmental achievement. (p. 35)
- The zone of proximal development [...] is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers. (p. 86)

Schoultz, J., Säljö, R., & Wydhamn, J. (2001). Heavenly Talk: Discourse, Artifacts, and Children's Understanding of Elementary Astronomy. *Human Development, 44*, 103-118.

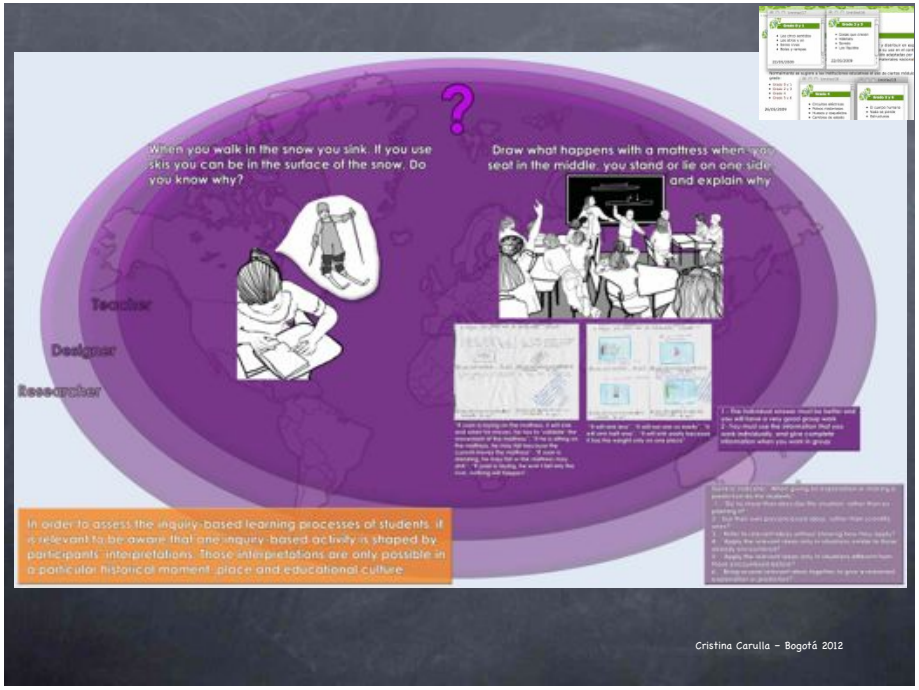
- Schoultz, et al., (2001)
- Instead of viewing understanding as the overt expression of underlying mental models,
- children's responses in interview studies should be regarded as situated and as dependent on the tools available as resources for reasoning.
- By modifying the interview situation through the introduction of a globe as a tool for thinking, the outcomes are radically different from those reported earlier.
- None of the problems that have been reported, where children, for instance, claim that people can fall of the earth, can be detected. Even among the youngest participants gravitation is often invoked as an explanatory concept. It is argued that the globe in this case serves as an efficient prosthetic device for thinking, and this illustrates the tool-dependent nature of human reasoning. (p. 103)

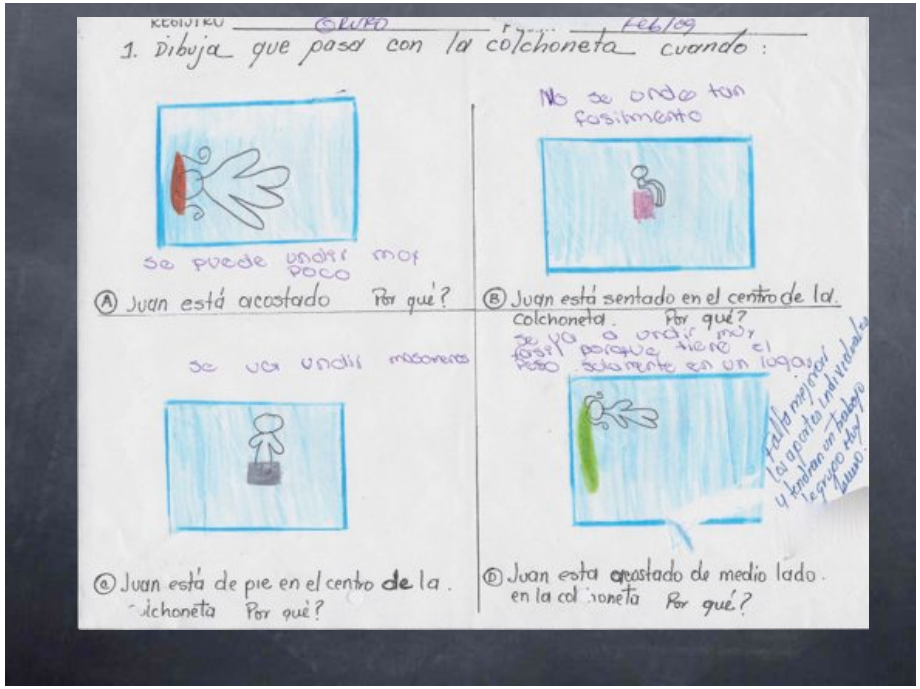
Roth, W.-M. (2007). *In search of Meaning and Coherence.* Rotterdam: Sense Publishers.

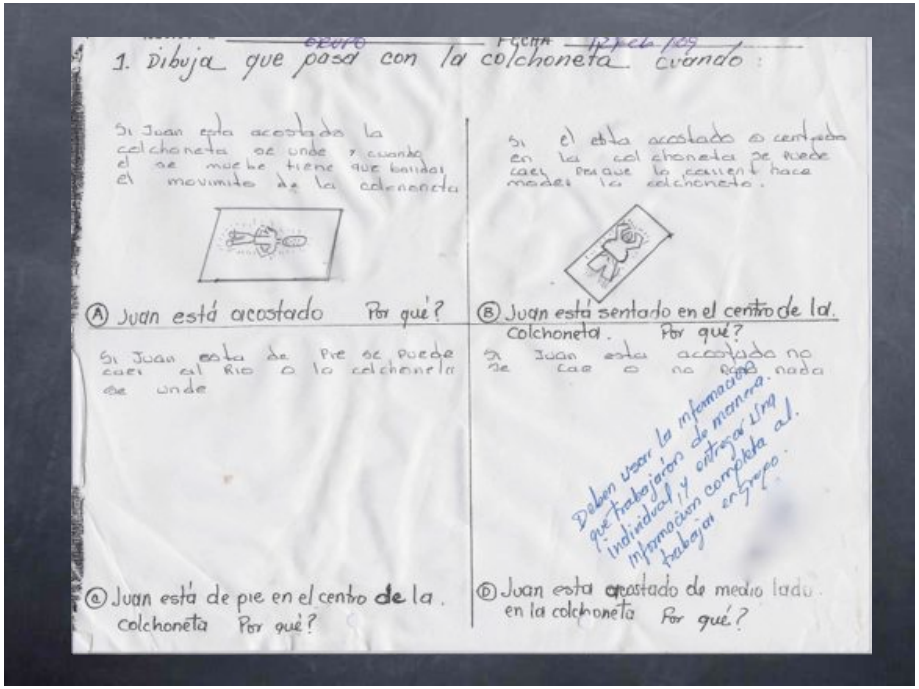
- Roth, (2007)
- Because interpretation arises from the interplay of existing understandings and experienced world, what one observes depends on what one already knows. This means that students who do not yet know the scientific principles will be unlikely to see just what their investigation is to show, for the very principles that are to be exhibited are prerequisite to seeing the phenomenon that is to be seen. As a result, students perceive different worlds than teachers making science learning through discovery next to impossible (p. 140)

Roth, W.-M. (2007). *In search of Meaning and Coherence.* Rotterdam: Sense Publishers.

- Roth, (2007)
- … the phenomena students constructed emerged from the intertwining of discursive and practical activity, interactions with others and the material world that was the focus of their activities. See thus, it is not surprising that students' phenomena often did not correspond to those the teacher wanted them to construct. (p. 166)





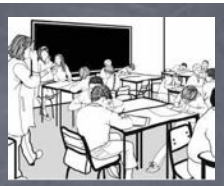


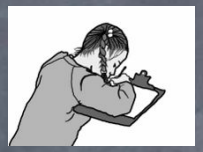
Contraste

La actividad en la que los estudiantes están involucrados puede verse de dos maneras distintas

- Como la forma de recoger información que evidencie el cambio conceptual o de las estructuras mentales, O como un marco que abre o cierra posibilidades de pensamiento.
- Las preguntas se pueden ver como enunciados que encierran un conocimiento particular o como un enunciado que tiene una diversidad de interpretaciones

Quino, 2006. El Tiempo: Bogotá





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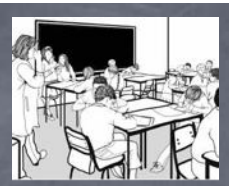
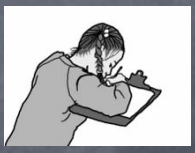
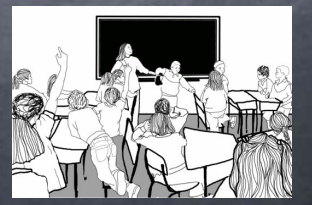


Gracias





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