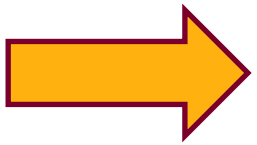
Retos sobre el pensamiento computacional

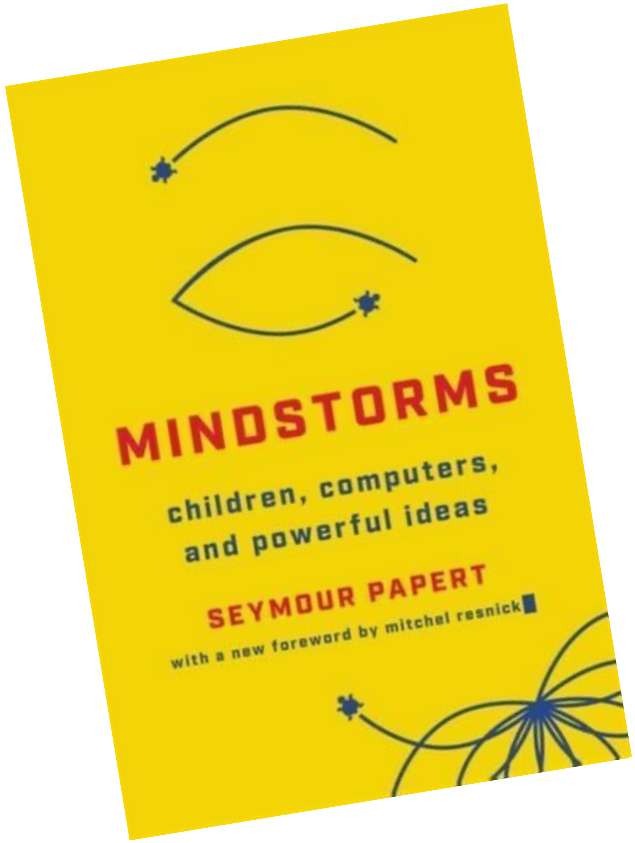
Jesús Moreno León

Índice



1960s

1980



In most cases, although the experiments have been interesting and exciting, they have failed to make it because they were too primitive. Their computers simply did not have the power needed for the most engaging and shareable kinds of activities. Their visions of how to integrate computational thinking into everyday life was insufficiently developed. But there will be more tries, and more and more. And eventually, somewhere, all the pieces will come together and it will "catch." One can be confident of this because such attempts will not be isolated experiments operated by researchers who may run out of funds or simply become disillusioned and quit. They will be manifestations of a social movement of people interested in personal computation, interested in their own children, and interested in education.

2006

Viewpoint | Jeannette M. Wing

Computational Thinking

It represents a universally applicable attitude and skill set everyone, not just computer scientists, would be eager to learn and use.

Computational thinking builds on the power and limits of computing processes, whether they are executed by a human or by a machine. Computational methods and models give us the courage to solve problems and design systems that no one of us would be capable of tackling alone. Computational thinking confronts the riddle of machine intelligence: What can humans do better than computers? and What can computers do better than humans? Most fundamentally it addresses the question: What is computable? Today, we know only parts of the answers to such questions.

Computational thinking is a fundamental skill for everyone, not just for computer scientists. To reading, writing, and arithmetic, we should add computational thinking to every child's analytical ability. Just as the printing press facilitated the spread of the three Rs, what is appropriately incestuous about this vision is that computing and computers facilitate the spread of computational thinking.

Computational thinking involves solving problems, designing systems, and understanding human behavior, by drawing on the concepts fundamental to computer science. Computational thinking includes a range of mental tools that reflect the breadth of the field of computer science.

Having to solve a particular problem, we might ask: How difficult is it to solve? and What's the best way to solve it? Computer science rests on solid theoretical underpinnings to answer such questions precisely. Stating the difficulty of a problem accounts for the underlying power of the machine—the computing device that will run the solution. We must consider the machine's instruction set, its resource constraints, and its operating environment.

In solving a problem efficiently, we might further ask whether an approximate solution is good enough, whether we can use randomization to our advantage, and whether false positives or false negatives are allowed. Computational thinking is reformulating a seemingly difficult problem into one we know how to solve, perhaps by reduction, embedding, transformation, or simulation.

Computational thinking is thinking recursively. It is parallel processing. It is interpreting code as data and data as code. It is type checking as the generalization of dimensional analysis. It is recognizing both the virtues and the dangers of aliasing, or giving someone or something more than one name. It is recognizing both the cost and power of indirect addressing and procedure call. It is judging a program not just for correctness and efficiency but for aesthetics, and a system's design for simplicity and elegance.

Computational thinking is using abstraction and decomposition when attacking a large complex task or designing a large complex system. It is separation of concerns. It is choosing an appropriate representation for a problem or modeling the relevant aspects of a problem to make it tractable. It is using invariants to describe a system's behavior succinctly and declaratively. It is having the confidence we can safely use, modify, and influence a large complex system without understanding its every detail. It is

LISA HANEY

2011

2012

Michael Gove to scrap 'boring' IT lessons

Schools to be given freedom to run cutting-edge computer classes under plans for open source curriculum

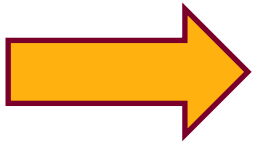
Ministers are keen to see universities and businesses creating a new computer science GCSE. Photograph: Frank Baron

The teaching of computer science in school is to be dramatically overhauled, with the existing programme of study scrapped to make way for new lessons designed by industry and universities, Michael Gove will announce on Wednesday.

In a speech, the education secretary will say the existing curriculum in Information and Communication Technology (ICT) has left children "bored out of their minds being taught how to use Word and Excel by bored teachers".

Instead he will, in effect, create an "open source" curriculum in computer science by giving schools the freedom to use teaching resources designed with input from leading employers and academics, in changes that will come into effect this September.

Índice

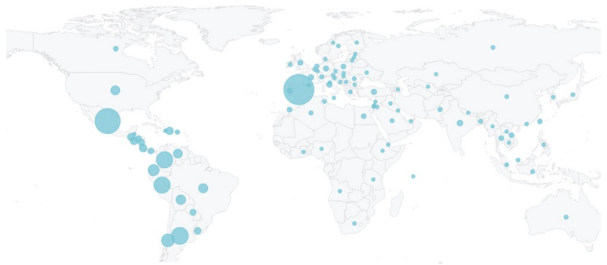


Programamos

Healing with Code

The Spanish non-profit Programamos is bringing Scratch to children in hospitals

The Scratch Team · Follow
Published in The Scratch Team Blog · 6 min read · May 19, 2017



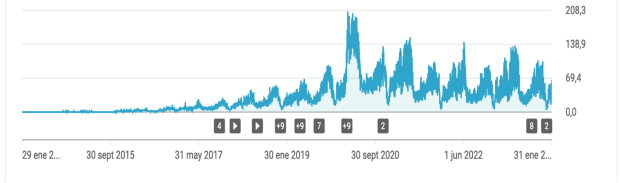
Total de estudiantes
53.524

Valoraciones
4096

Udemy

YouTube ES

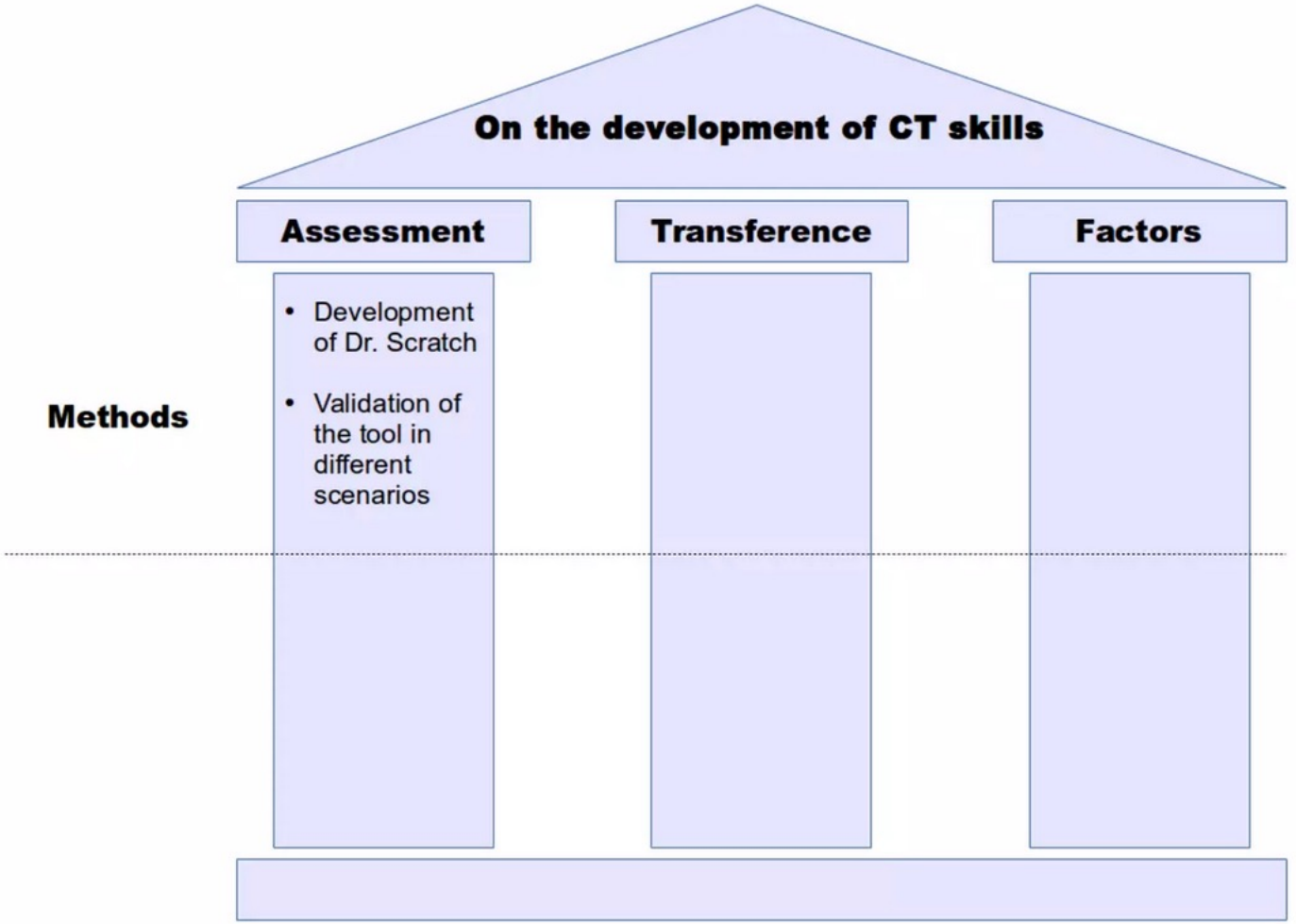
Visualizaciones	Tiempo de visualización (horas)
3,1 M	120,7 mil



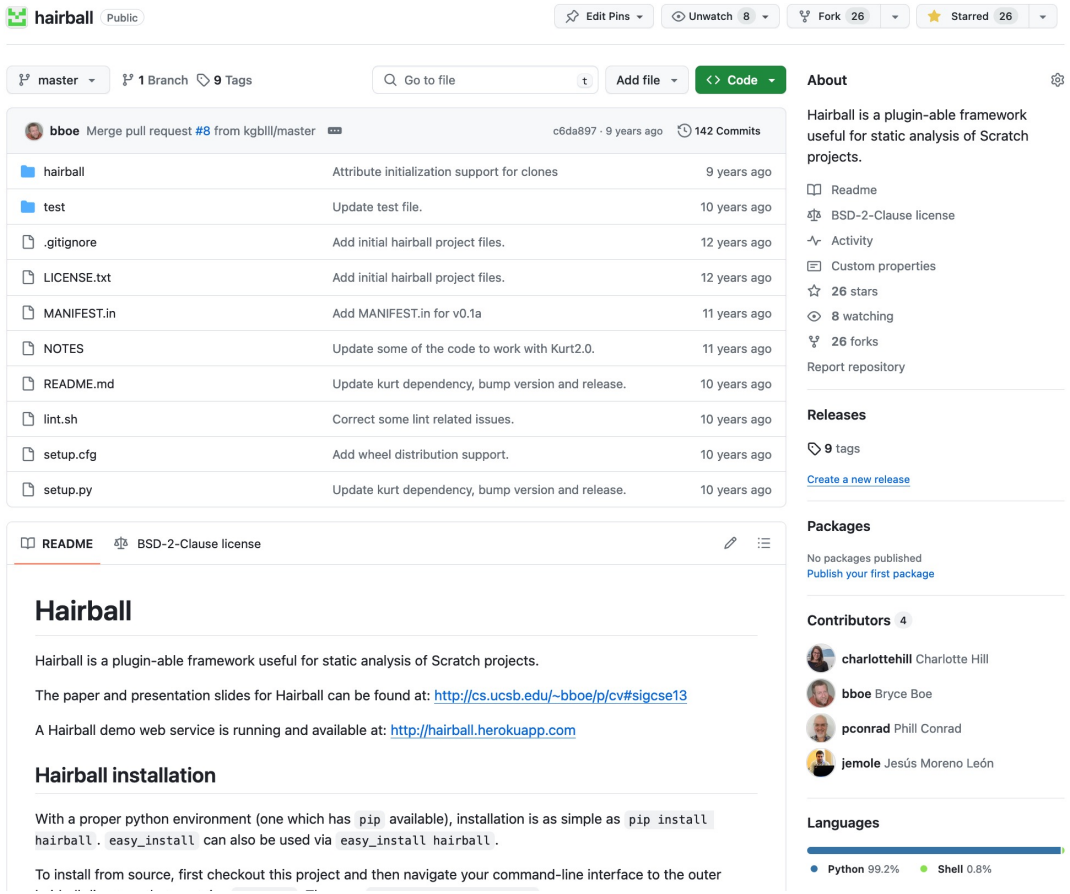
Administraciones públicas: “¡evidencias!”

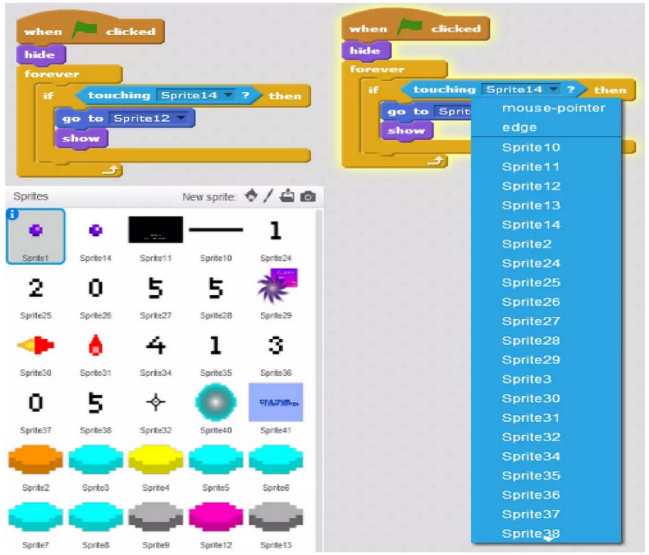
Índice

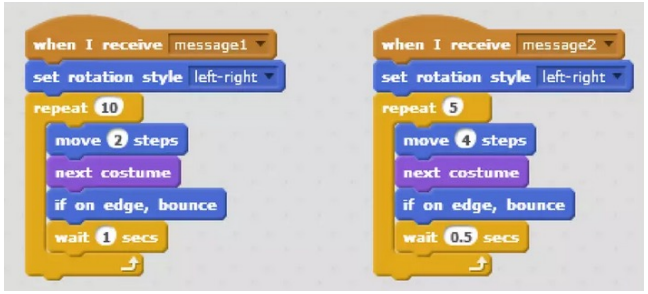
Investigación KGBL3



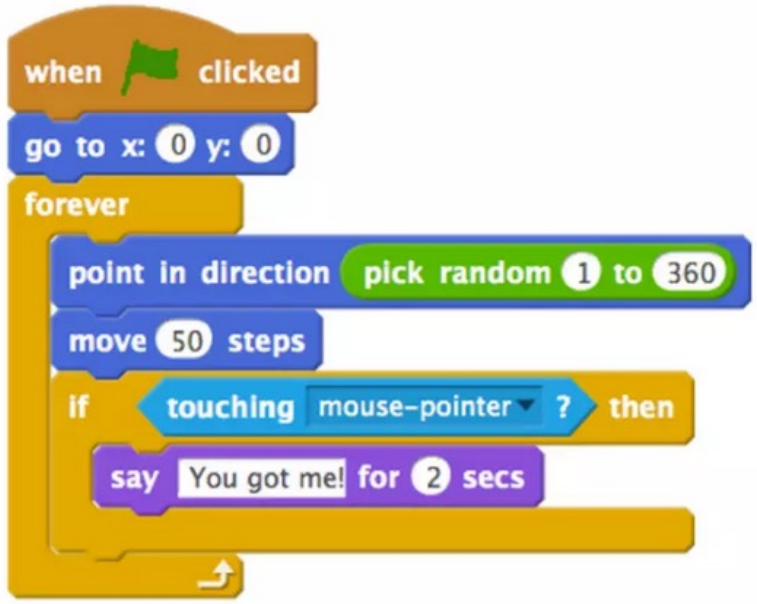
Investigación KGBL3: evaluación







Investigación KGBL3: evaluación



CT dimension	Basic	Developing	Proficient
Data representation	modifiers of sprites properties	operations on vars	operations on lists
Logical Thinking	if	if else	logic operations
User interactivity	green flag	key pressed, sprite clicked, ask and wait, mouse blocks	when %s is >%s, video, audio
Algotithmic notions of flow control	sequence of blocks	repeat, forever	repeat until
Abstraction and problem decomposition	more than one script and more than one sprite	def block	when I start as clone
Parallelism	Two scripts on green flag	Two scripts on key pressed, two scripts on sprite clicked on the same sprite	Two scripts on when I receive message, two scripts when %s is >%s, two scripts on when backdrop change to
Synchronization	wait	Broadcast, when I receive message, stop all, stop program, stop programs sprite	wait until, when backdrop change to, broadcast and wait

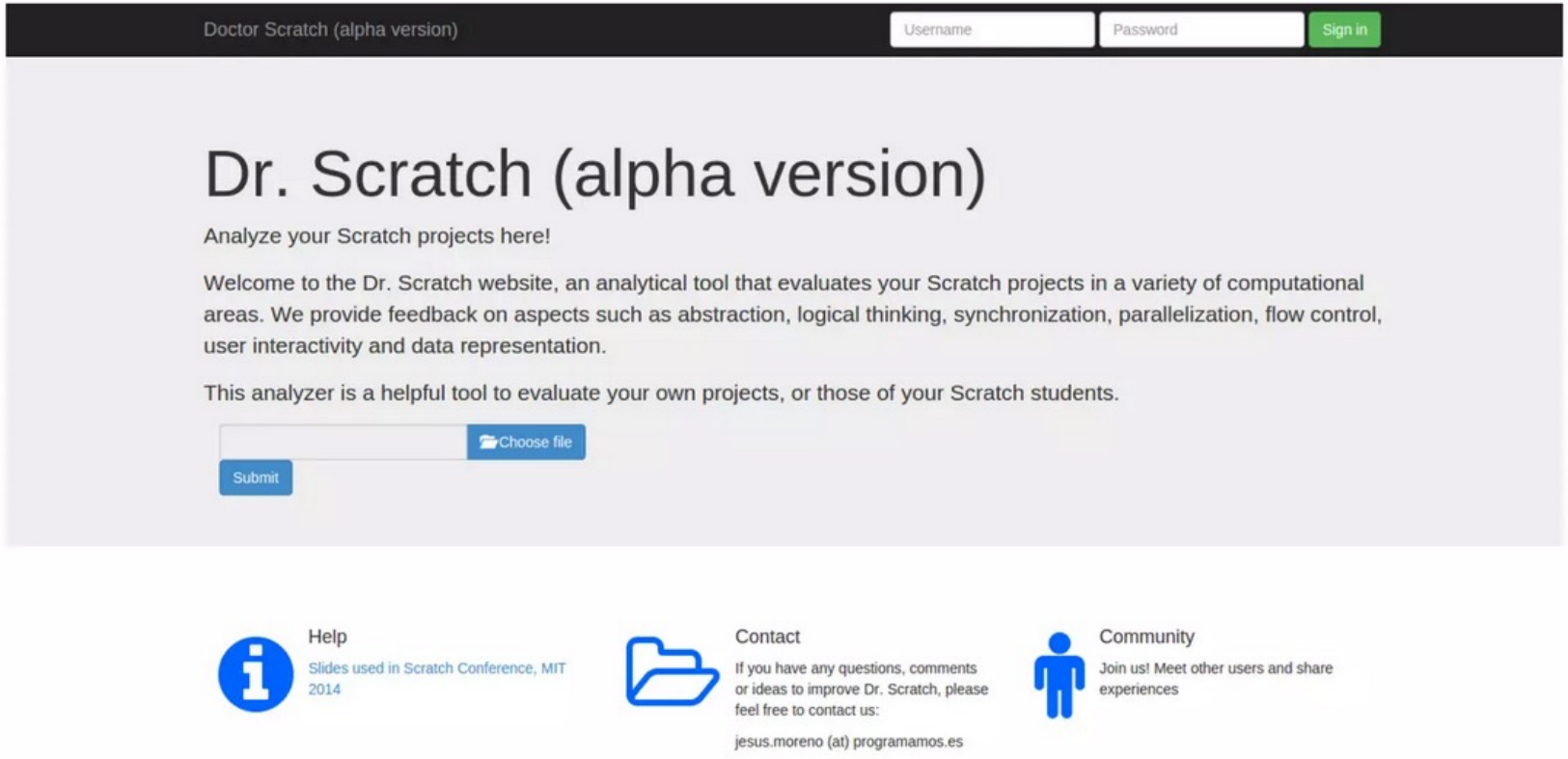
Investigación KGBL3: evaluación

```
chen@th:~$ hairball -p mastery.Mastery Catch\ me\ if\ you\ can.sb2
Catch me if you can.sb2
{'Abstraction': 0, 'Parallelization': 0, 'Logic': 1, 'Synchronization': 0, 'FlowControl
': 2, 'UserInteractivity': 2, 'DataRepresentation': 1}
Total mastery points: 6/21
Average mastery points: 0.86/3
Overall programming competence: Basic
```

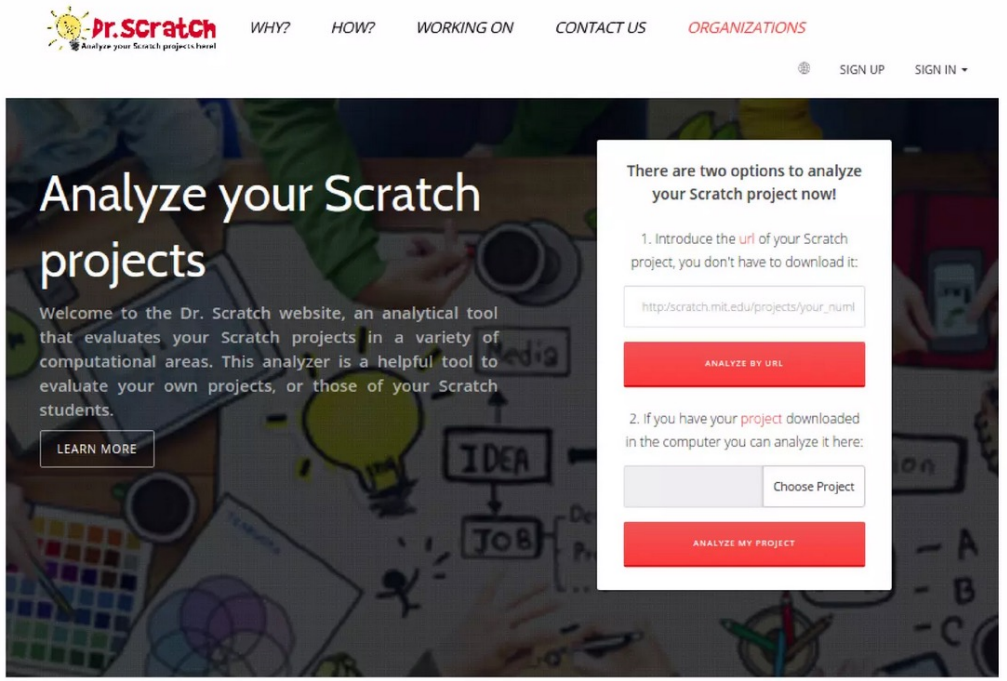
Total Physical Source Lines of Code	1,809
Dominant language	Python
Schedule Estimate, Months	4.42
Estimated Average Number of Developers	1.01
Total Estimated Cost to Develop	$50,345

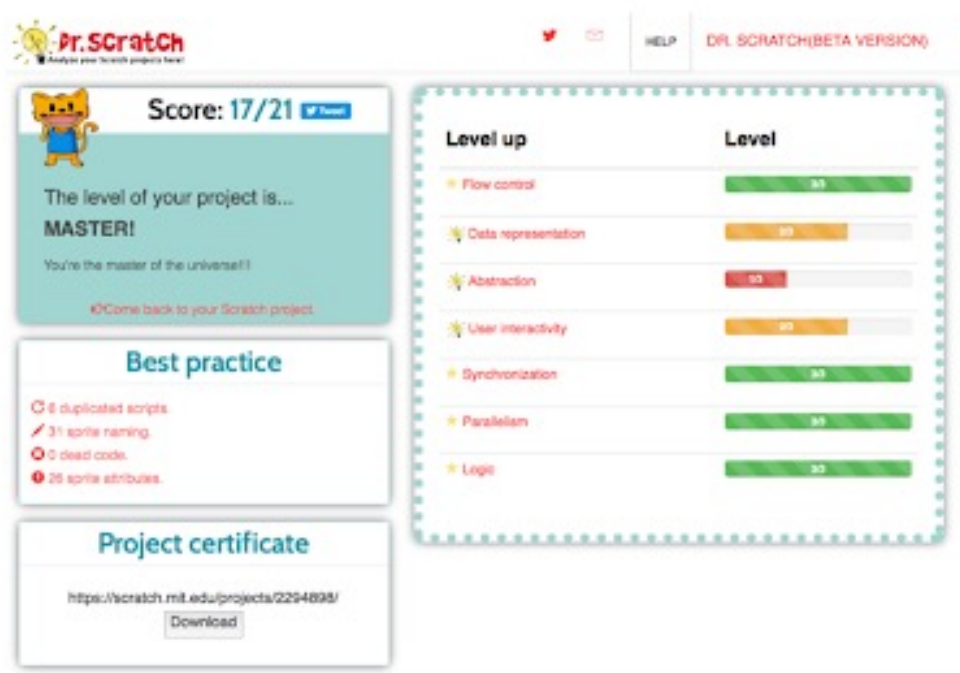
Table: Estimated effort for the development of the `Hairball` fork (using the *basic* COCOMO estimation model [Boehm et al., 2000]).

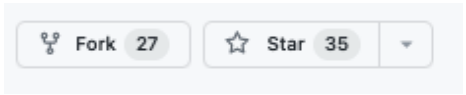
Investigación KGBL3: evaluación



Investigación KGBL3: evaluación

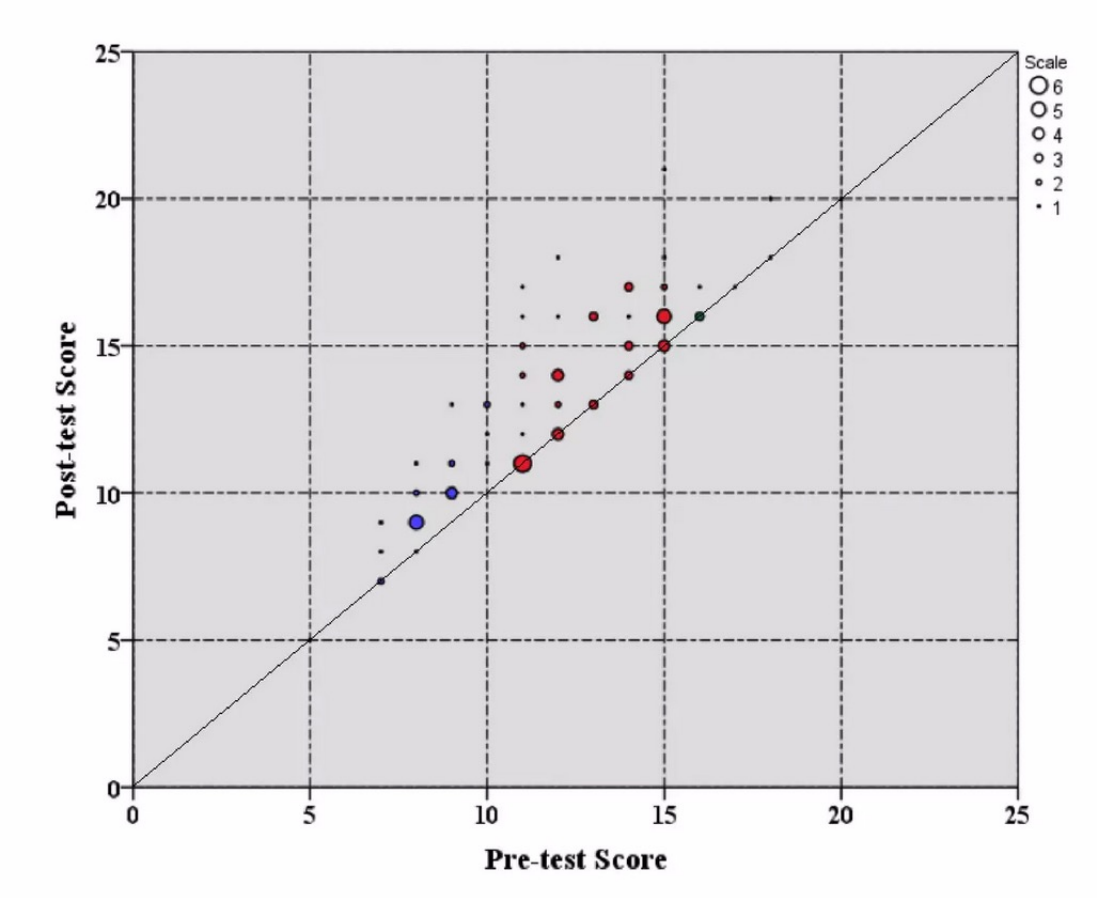


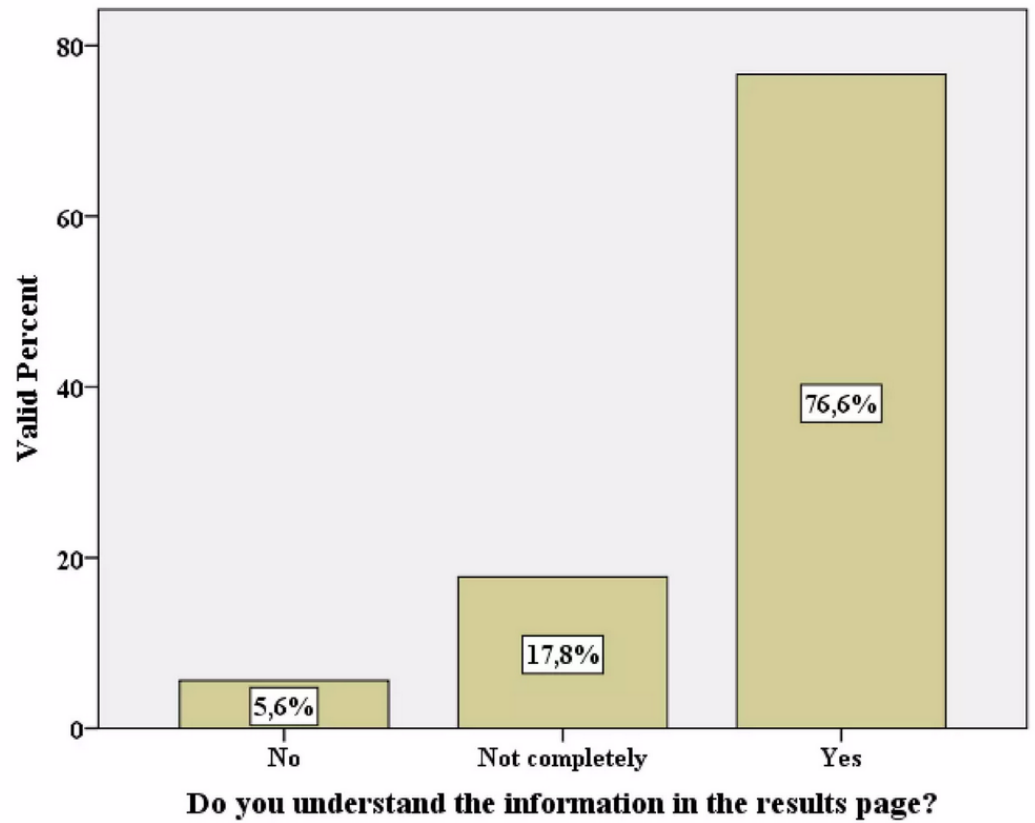




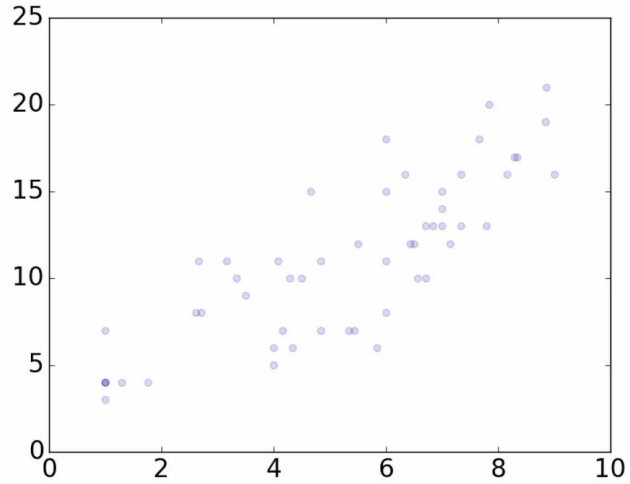
~ 100.000 proyectos analizados/año

Investigación KGBL3: evaluación



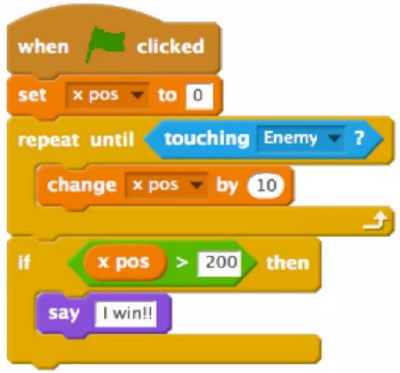


Investigación KGBL3: evaluación

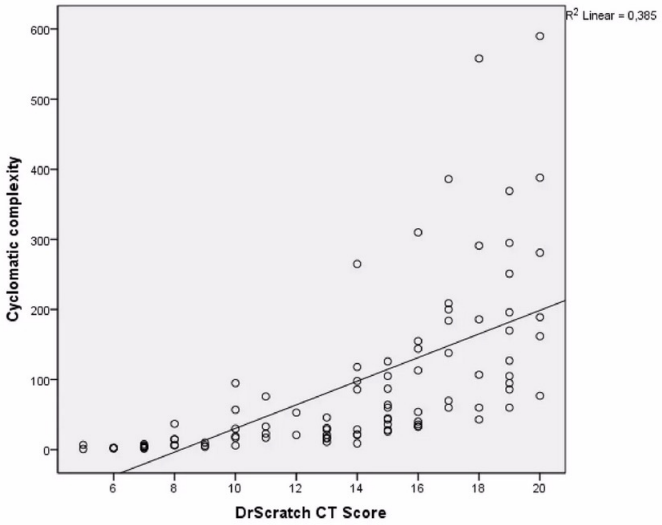


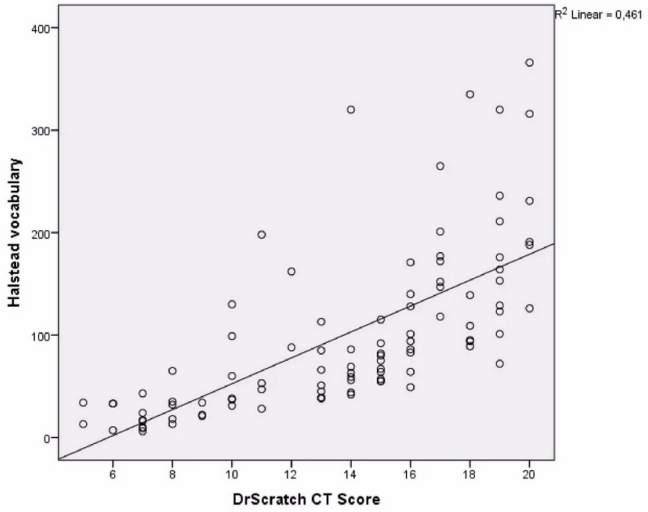
Scatter plot for experts evaluation (x-axis) and Dr. Scratch assessment (y-axis).

Investigación KGBL3: evaluación

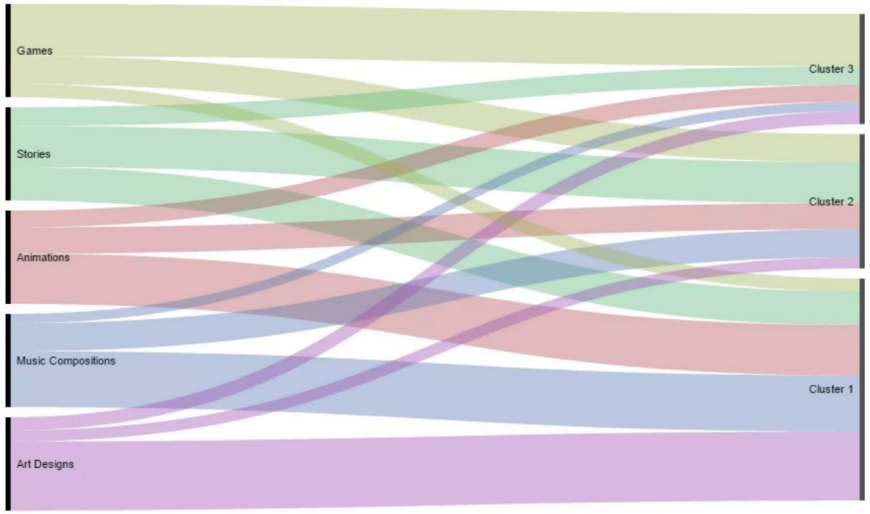


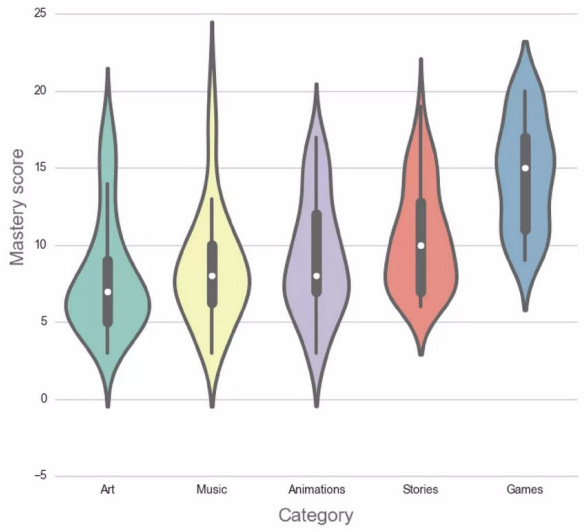
Metric	Value
Cyclomatic complexity	3
Vocabulary	14
Length	14
Volume	66.42
Difficulty	53.30
Effort	293.86

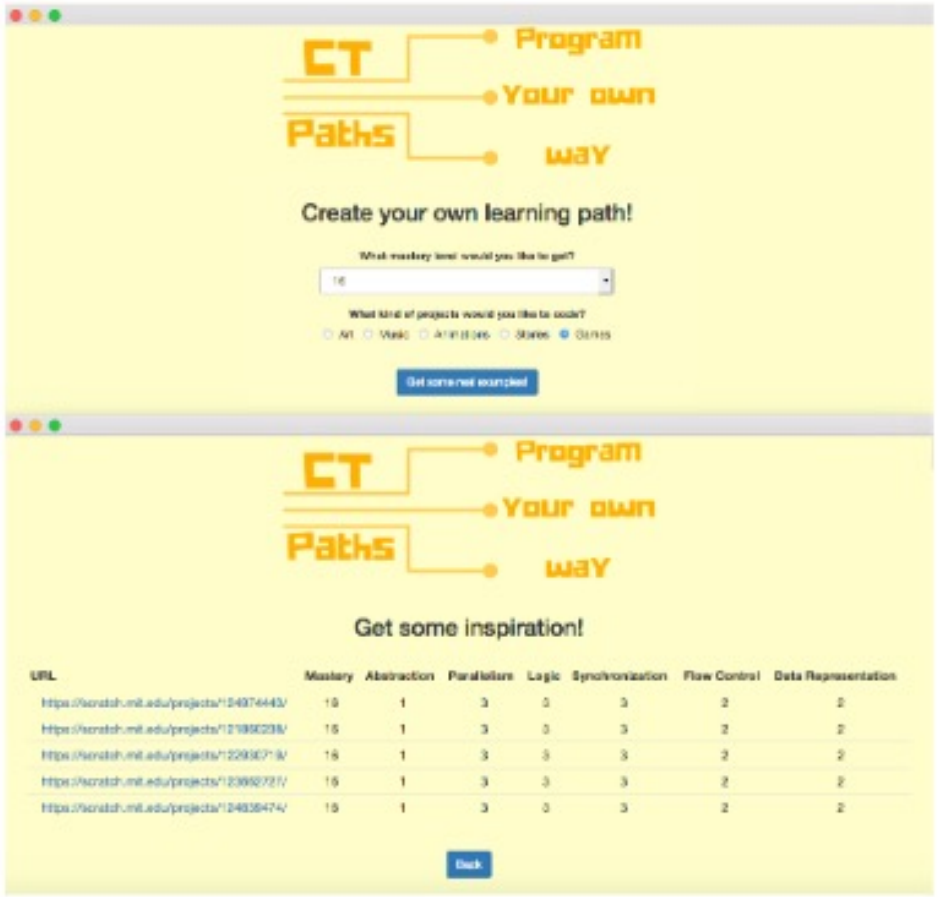




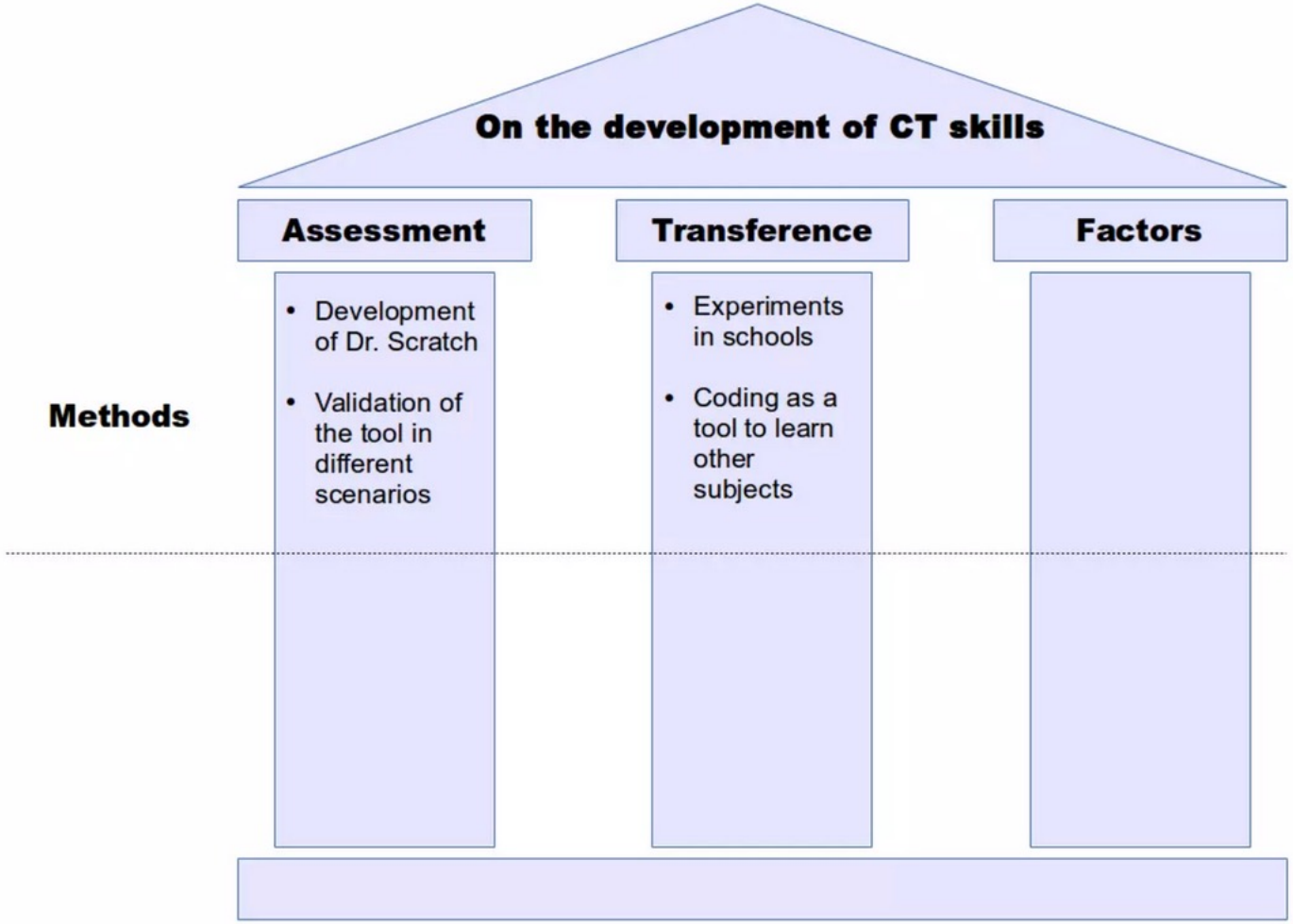
Investigación KGBL3: evaluación







Investigación KGBL3: transferencia



Investigación KGBL3: transferencia

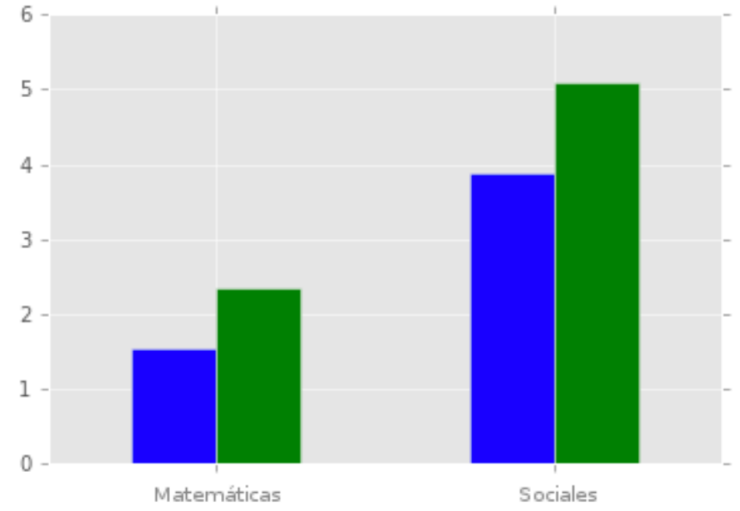


Figura 2: Mejora experimentada entre la prueba inicial y final: a la izquierda, los resultados para la clase de Matemáticas; a la derecha, los de la clase de Ciencias Sociales. Los grupos de control se muestran en color azul; los grupos expermientales en color verde.

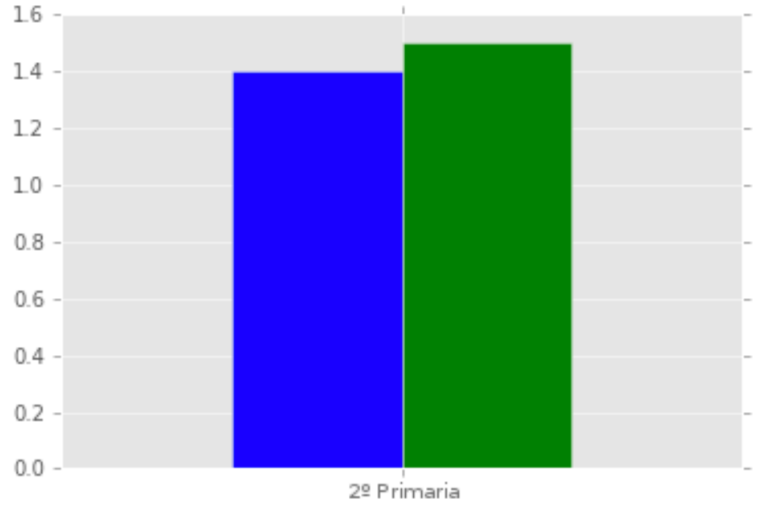


Figura 3: Mejora experimentada entre la prueba inicial y final: resultados para la clase de 2º de Primaria. El grupo de control se muestra en color azul; el grupo expermiental en color verde.

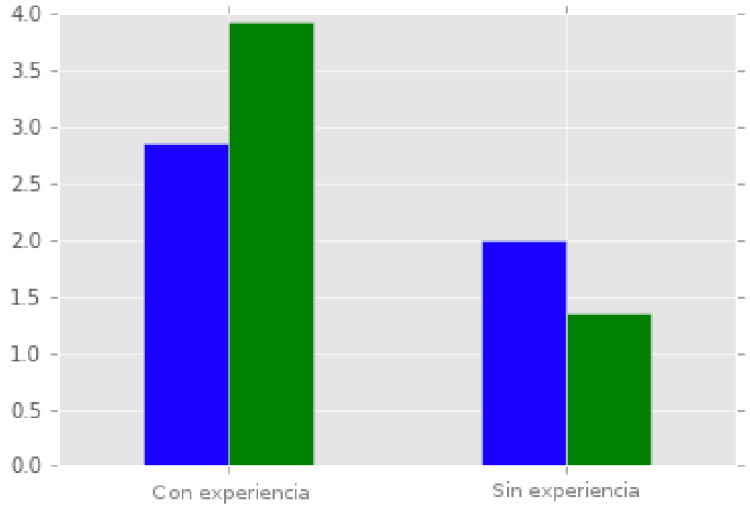
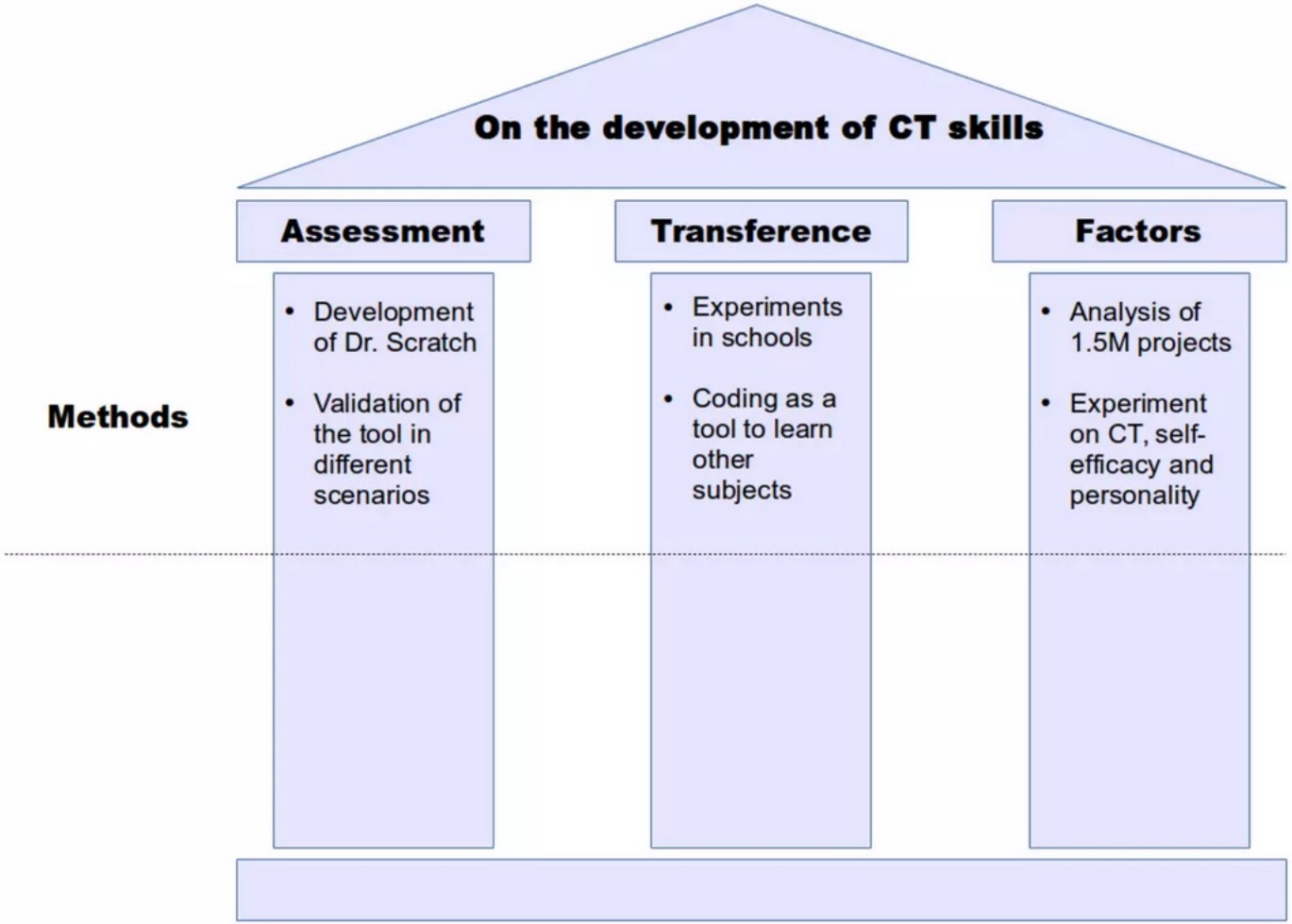


Figura 4: Mejora experimentada entre la prueba inicial y final: a la izquierda, los resultados para la clase del docente con experiencia previa en programación; a la derecha, los de la clase del docente sin experienca previa. Los grupos de control se muestran en color azul; los grupos expermientales en color verde.

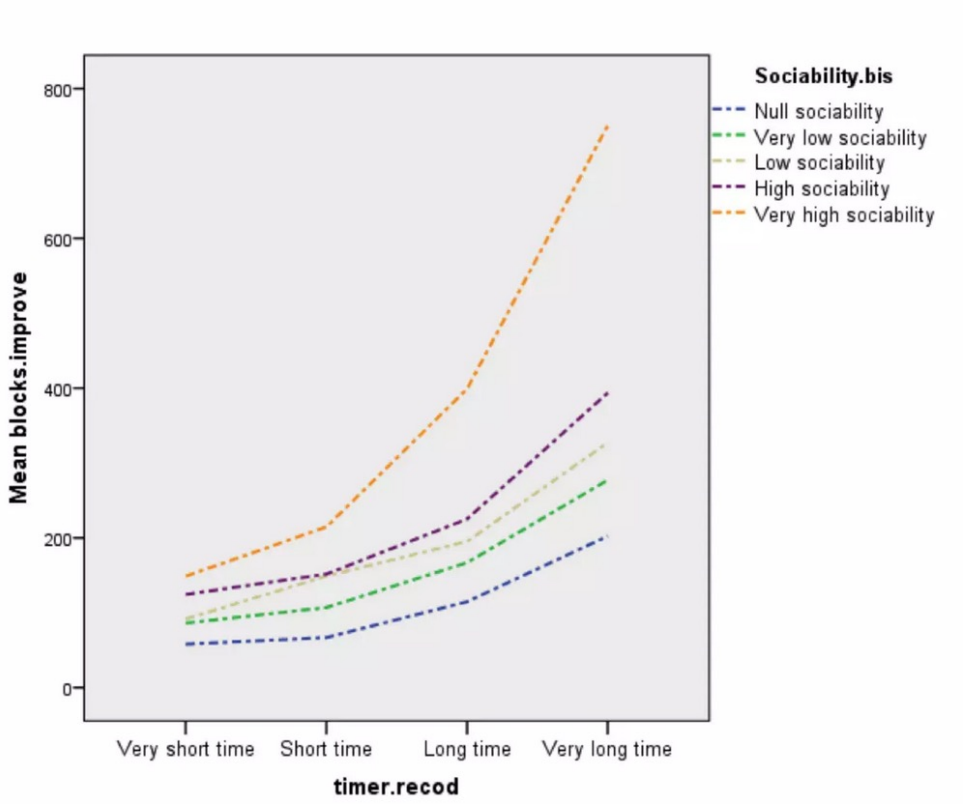
Investigación KGBL3: factores



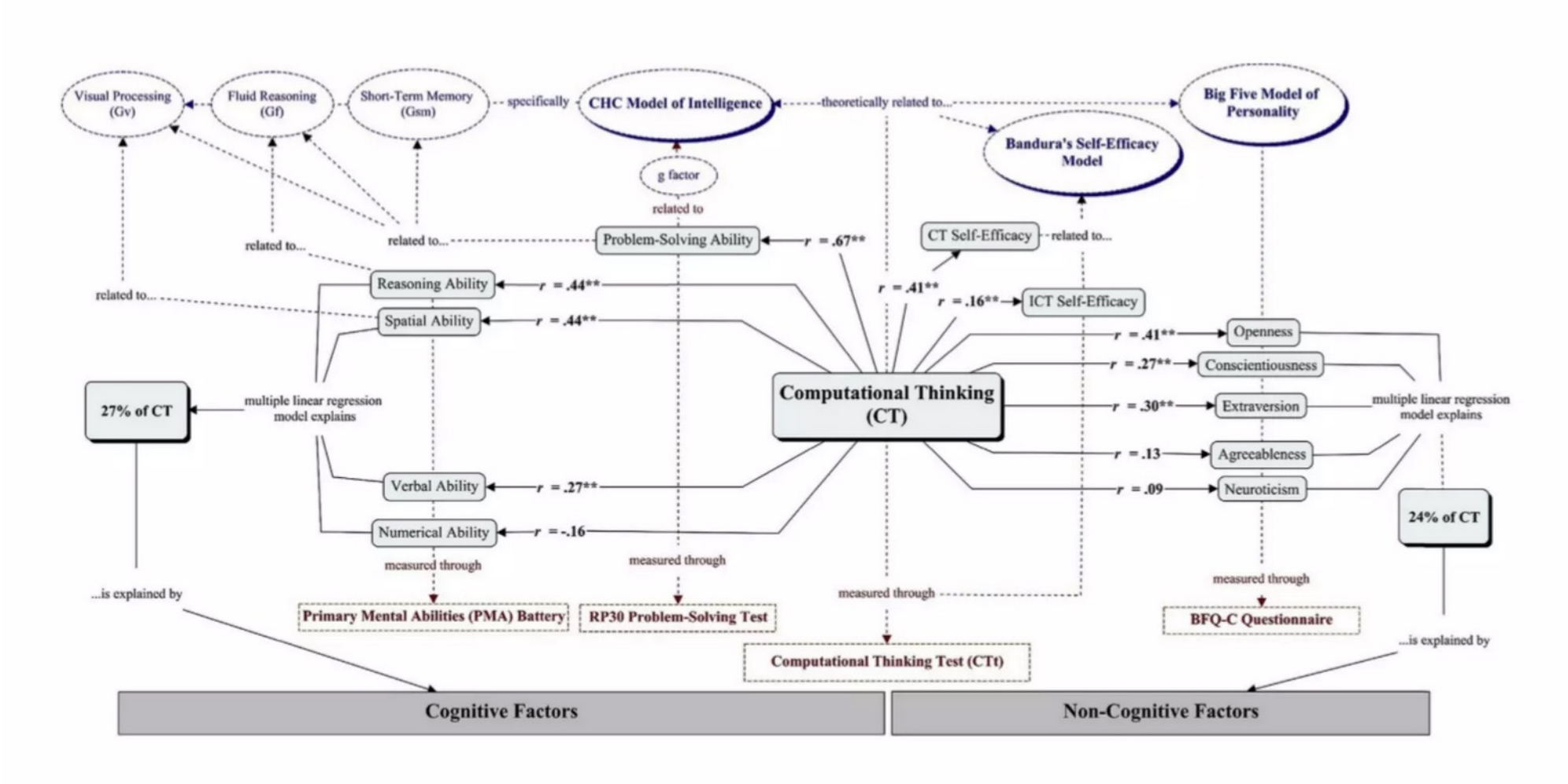
Investigación KGBL3: factores

Data set of public activity in the Scratch online community during its first five years of activity (2007–2012)

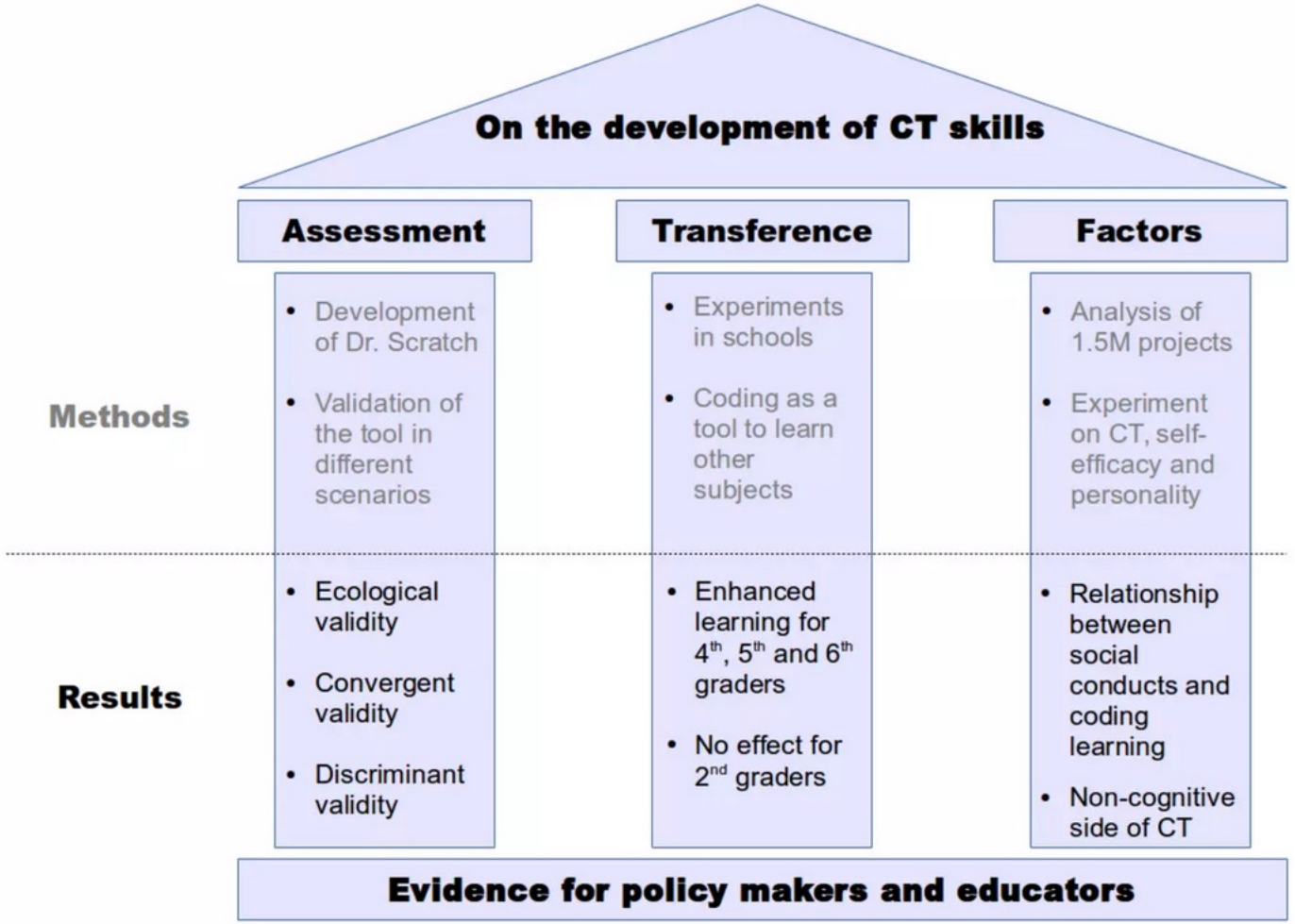
- **1,056,951 users**
- **1,928,699 projects**
- **120,097 galleries**
- **1,313,200 friends**
- **7,788,414 comments in projects**



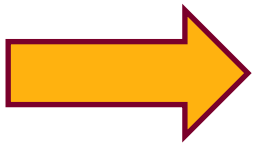
Investigación KGBL3: factores



Investigación KGBL3



Índice



Ministerio de Educación

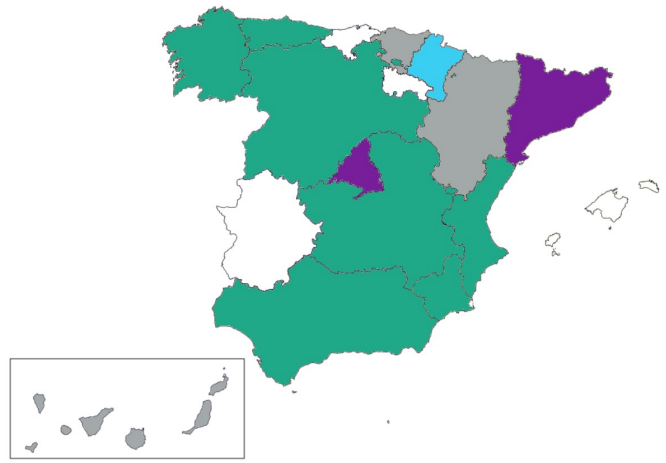


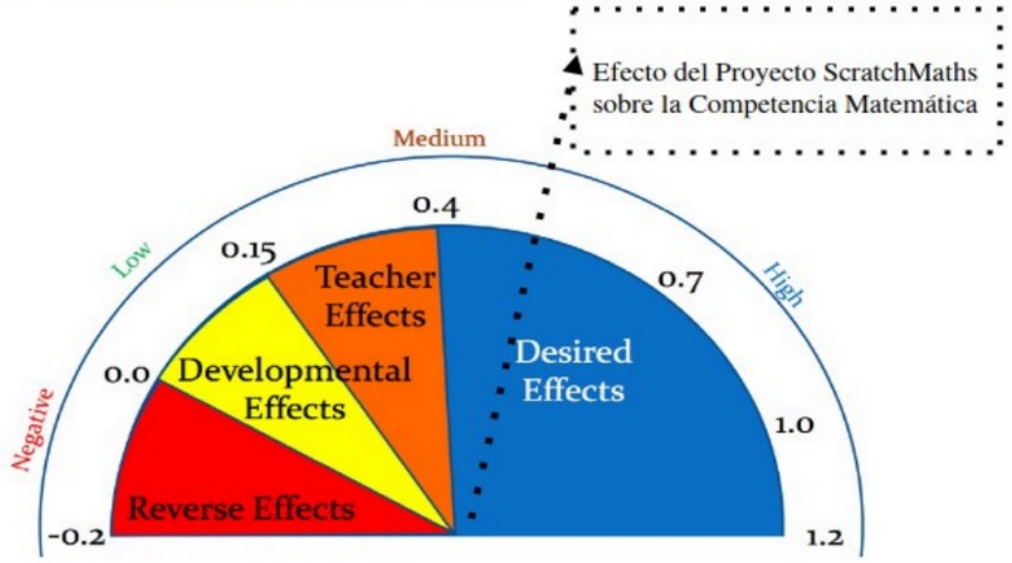
Figura 2.2: *Comunidades Autónomas que han incluido nuevas asignaturas o contenidos sobre programación, robótica y pensamiento computacional. En color azul aparecen aquellas que lo han hecho en Primaria; verde, en Secundaria; morado, en ambos niveles educativos. Las Comunidades Autónomas que no participan en el estudio aparecen en gris.*

Ministerio de Educación

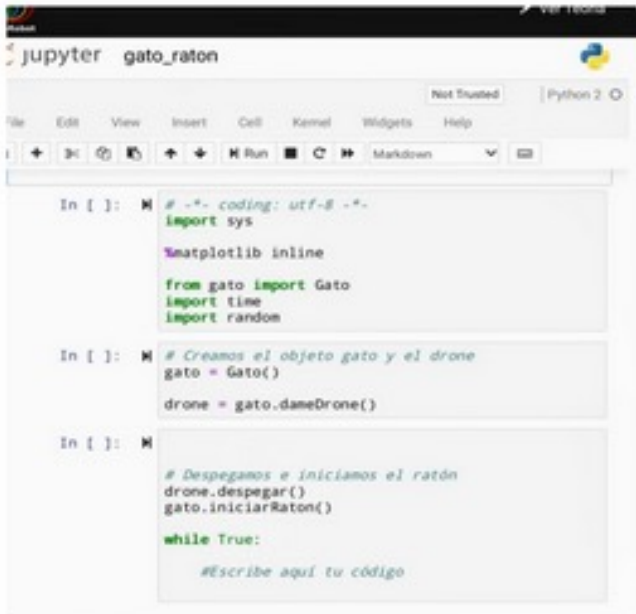
Gráfico 4. Fases y cronograma de la investigación

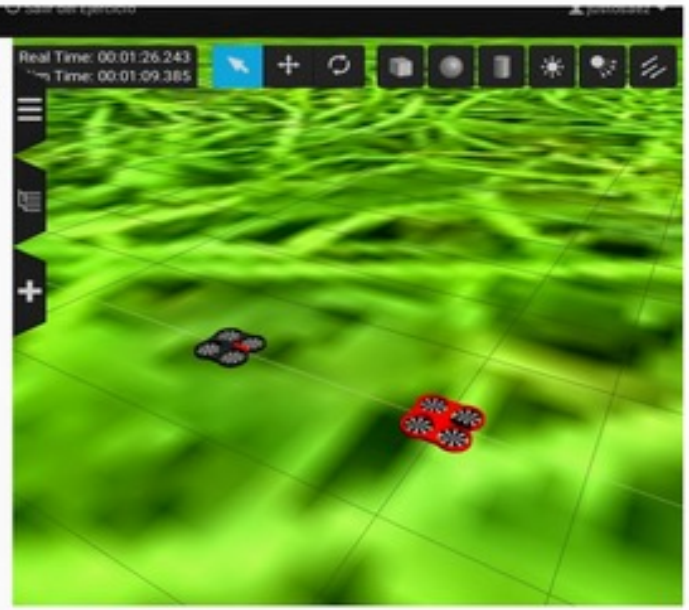
Diciembre	Enero	Febrero	Marzo	Abril	Mayo	Junio
Formación del profesorado						
		Pre-test				
			Implementación en el aula			
						Post-test

Gráfico 12. "Barómetro de la influencia" (Hattie, 2009).



Ministerio de Educación





Ministerio de Educación

escuela de pensamiento computacional e inteligencia artificial

GOBIERNO DE ESPAÑA · MINISTERIO DE EDUCACIÓN Y FORMACIÓN PROFESIONAL

intef INSTITUTO NACIONAL DE TECNOLOGÍAS EDUCATIVAS Y DE FORMACIÓN DEL PROFESORADO

Nivel I
Infantil y primaria (1º, 2º y 3º)

En este nivel se propone trabajar haciendo uso de actividades unplugged (desenchufadas o desconectadas), que hacen uso de juegos de lógica, vasos, cuerdas, cartas o movimientos físicos, que se utilizan para representar y comprender diferentes conceptos relacionados con la IA, como algoritmos o representación de datos.

Nivel II
Primaria (4º, 5º y 6º) y secundaria (1º y 2º)

En este nivel el alumnado debe reconocer cómo los sistemas informáticos que utilizan en su día a día hacen uso de la IA para percibir el mundo usando sensores, razonar, aprender e interactuar con humanos. Además, los estudiantes deben recapacitar sobre el impacto que la IA puede tener en la sociedad, tanto de modo positivo como negativo. Y el mejor modo de lograr estos objetivos es que construyan sus propias creaciones software, como un videojuego sencillo, que integre soluciones de IA, en especial las relacionadas con el aprendizaje automático o machine learning.

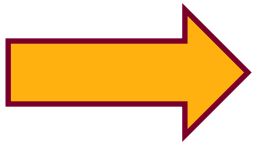
Nivel III
Secundaria (3º y 4º), Bachillerato y FP

En este nivel, para alcanzar los mismos objetivos marcados para el nivel II, se realizarán proyectos de desarrollo de aplicaciones para dispositivos móviles que integren soluciones de IA.

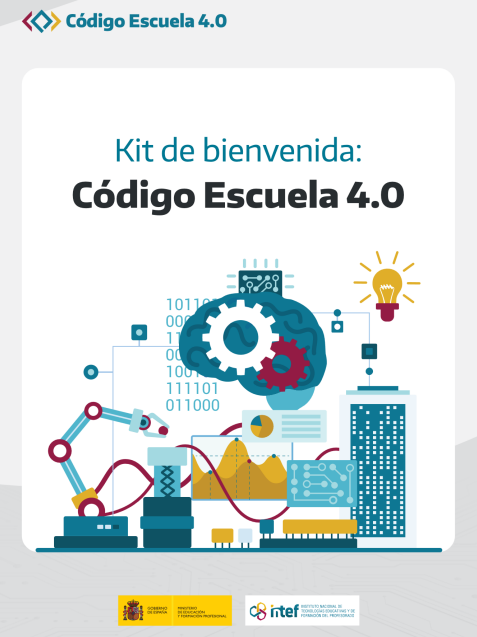
Ministerio de Educación

	Al completar este nivel educativo el alumno o la alumna...	Áreas o materias
INFANTIL	Desarrolla, de manera progresiva, las destrezas del pensamiento computacional a través de procesos de observación y manipulación de objetos para iniciarse en la interpretación del entorno y responder de forma creativa a las situaciones y retos que se plantean.	Área 2. Descubrimiento y exploración del entorno (en el 2º ciclo)
PRIMARIA	Se inicia en el desarrollo de soluciones digitales sencillas y sostenibles (reutilización de materiales tecnológicos, programación informática por bloques, robótica educativa...) para resolver problemas concretos o retos propuestos de manera creativa, solicitando ayuda en caso necesario.	Conocimiento del medio natural, social y cultural (en los 3 ciclos) y Matemáticas (en los 3 ciclos)
E.S.O.	Desarrolla aplicaciones informáticas sencillas y soluciones tecnológicas creativas y sostenibles para resolver problemas concretos o responder a retos propuestos, mostrando interés y curiosidad por la evolución de las tecnologías digitales y por su desarrollo sostenible y uso ético.	Tecnología y Digitalización (1º, 2º y 3º), Tecnología (4º), Digitalización (4º), Biología y Geología (1º, 2º, 3º y 4º), Matemáticas (1º, 2º y 3º), Matemáticas A y B (4º), Ámbito Ciencias Aplicadas (CFGB)
BACHI-LLERATO	Desarrolla soluciones tecnológicas innovadoras y sostenibles para dar respuesta a necesidades concretas, mostrando interés y curiosidad por la evolución de las tecnologías digitales y por su desarrollo sostenible y uso ético	Tecnología e Ingeniería I y II, Biología, Geología y Ciencias Ambientales (1º), Geología y Ciencias Ambientales (2º), Matemáticas I y II, Matemáticas Aplicadas a las Ciencias Sociales I y II, Matemáticas Generales

Índice



Didáctica del pensamiento computacional



Actuación 2: Acompañamiento al profesorado

CC.AA.	N.º de alumnos 40% 1	N.º de centros 15% 2	N.º de unidades 40% 3	Dispersión población 5% 4	Ponderación (1)= 40% (2)= 15% (3)= 40% (4)= 5%	Total
Andalucía.	759.863	2.526	36.740	1.512.197	19,54	19.422.274,00
Aragón.	109.551	406	5.997	340.351	3,07	3.052.981,00
P. Asturias.	64.727	291	3.580	328.925	1,94	1.932.630,00
I. Balears.	96.865	317	5.701	450.576	2,82	2.807.267,00
Canarias.	152.805	675	7.905	951.857	4,55	4.521.579,00
Cantabria.	45.693	192	2.607	241.570	1,38	1.370.049,00
Castilla y León.	171.653	836	10.314	928.424	5,43	5.396.147,00
Castilla-La Mancha.	183.182	776	10.360	726.581	5,39	5.362.147,00
Cataluña.	671.941	2.368	31.003	1.281.193	17,10	16.993.525,00
C. Valenciana.	417.967	1.376	22.560	710.154	11,16	11.095.096,00
Extremadura.	86.776	483	5.412	427.143	2,83	2.817.328,00
Galicia.	188.477	881	10.454	1.498.134	5,97	5.937.165,00
C. Madrid.	560.503	1.304	30.448	302.046	14,06	13.980.596,00
R. Murcia.	154.920	508	7.449	359.055	3,99	3.968.071,00
La Rioja.	27.752	86	1.488	77.034	0,75	743.145,00
Totales.	3.692.675	13.025	192.018	10.135.240	100,00	99.400.000,00

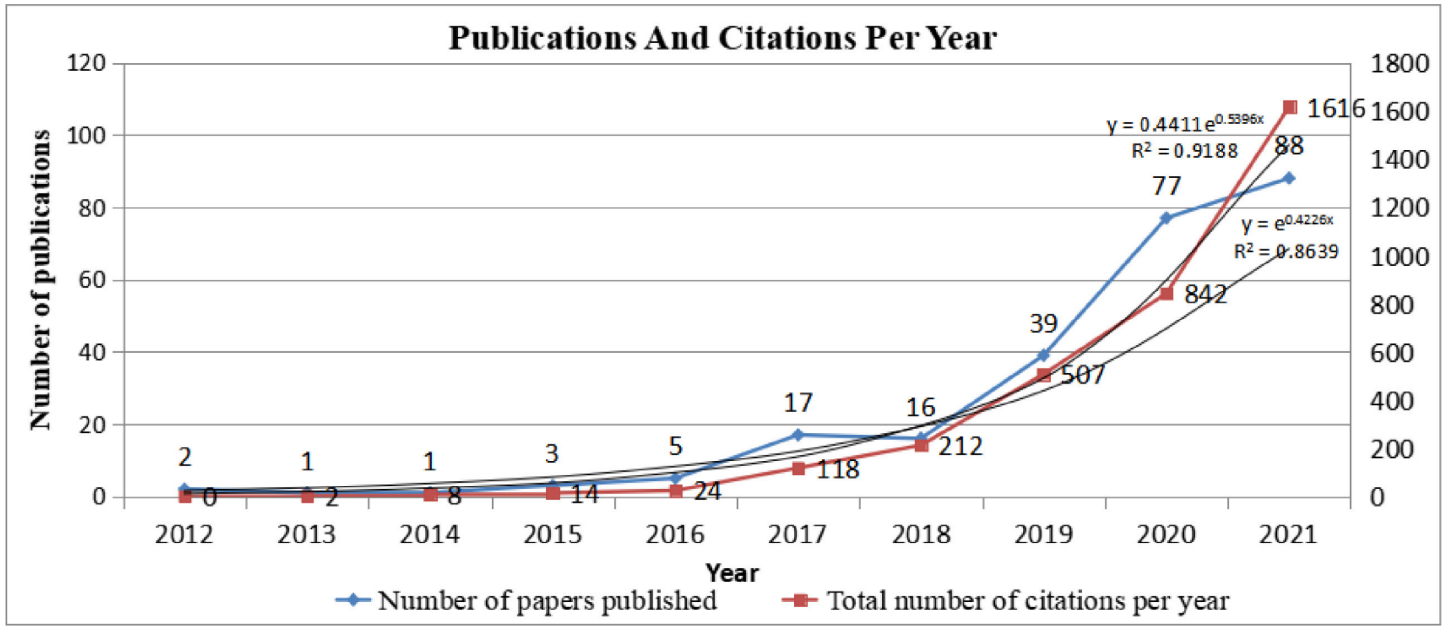
- Herramientas
- Recursos
- Lenguajes
- Edades
- Enfoques
- …

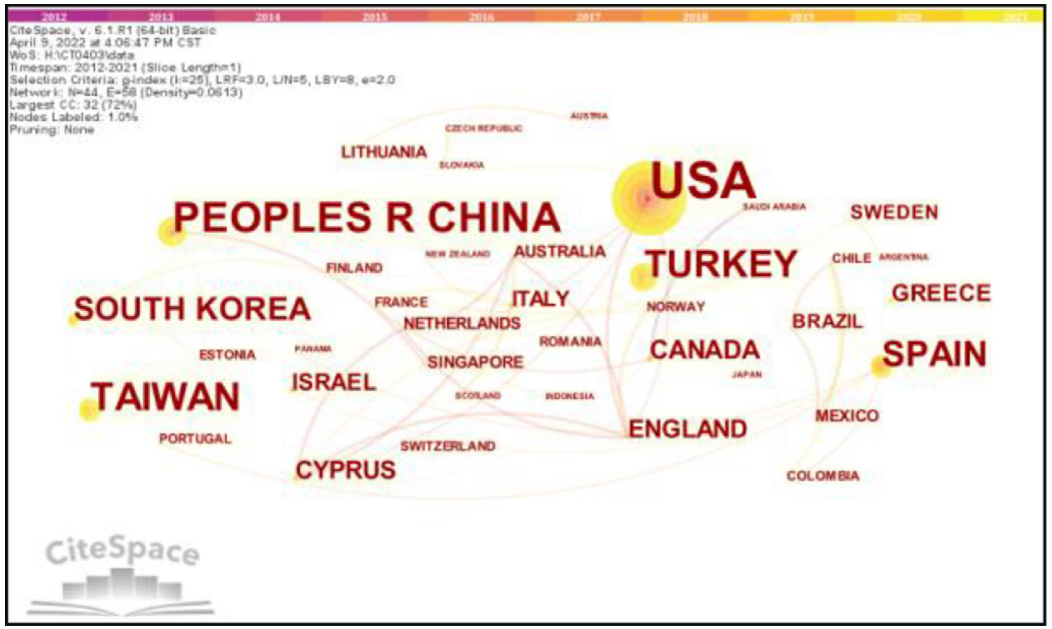
Didáctica del pensamiento computacional

Dinamismo del pensamiento computacional

Todavía quedan muchos retos sobre los que investigar en relación con el pensamiento computacional

¿Pero esto le interesa a alguien?



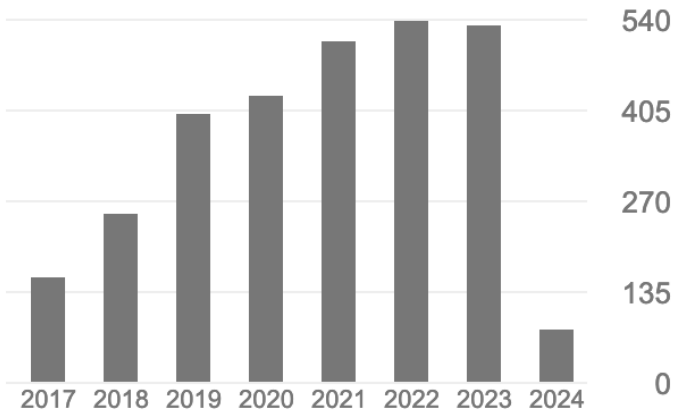


Visualising trends in computational thinking research from 2012 to 2021: A bibliometric análisis

https://doi.org/10.1016/j.tsc.2022.101224

¿Pero esto le interesa a alguien?

Citado por		VER TODO
	Total	Desde 2019
Citas	3004	2486
Índice h	27	25
Índice i10	31	31



¡Muchas gracias!

Jesús Moreno León

Dpto. de Lenguajes y Sistemas Informáticos

jmorenol@us.es

Retos sobre el pensamiento computacional

Jesús Moreno León