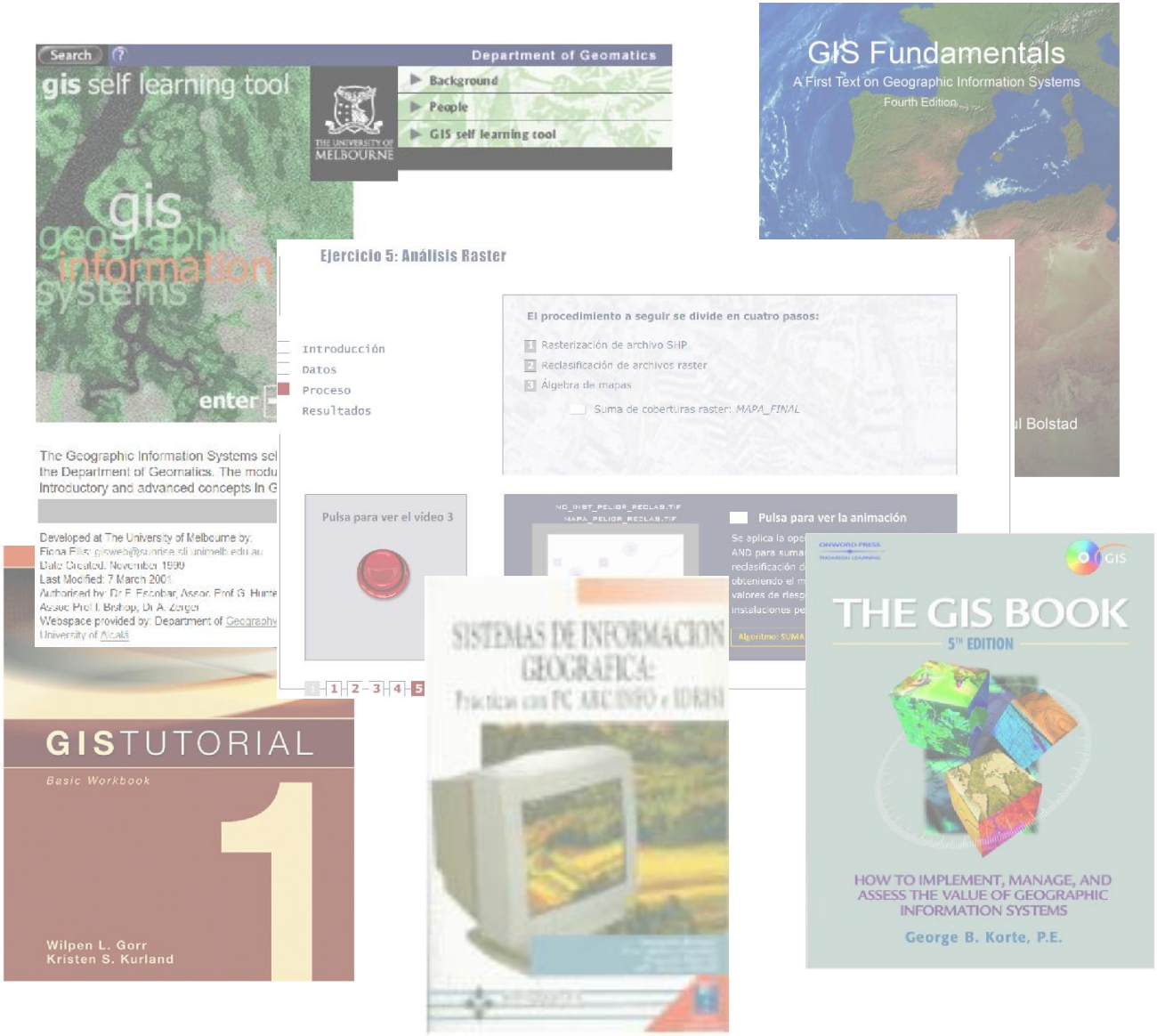
Past, present and future of GIS education: experiences from Australia and Europe



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Universidad de Alcalá

Content

- Intro - GIS into tertiary education
- Multimedia tools in GIS teaching and learning
- GISWEB – a self learning GIS tool
- Current resources for GIS learning and teaching
- GIS competencies in the European Higher Education Area (EHEA)
- Final remarks

The uptake of GIS in tertiary education

- Late 1980's and early 1990's – informal training courses
- Late 1990's - GIS subjects in university under and postgraduate studies (Geography and Engineering mainly)
- Early 2000's – GIS courses in all Earth Sciences and Civil, Geodetic and Environmental Engineering
- Today – GIS is ubiquitous (Public Health, Management, Business, Criminology…)

Lack of agreement among universities

Unstructured contents

Multimedia tools in GIS teaching and learning

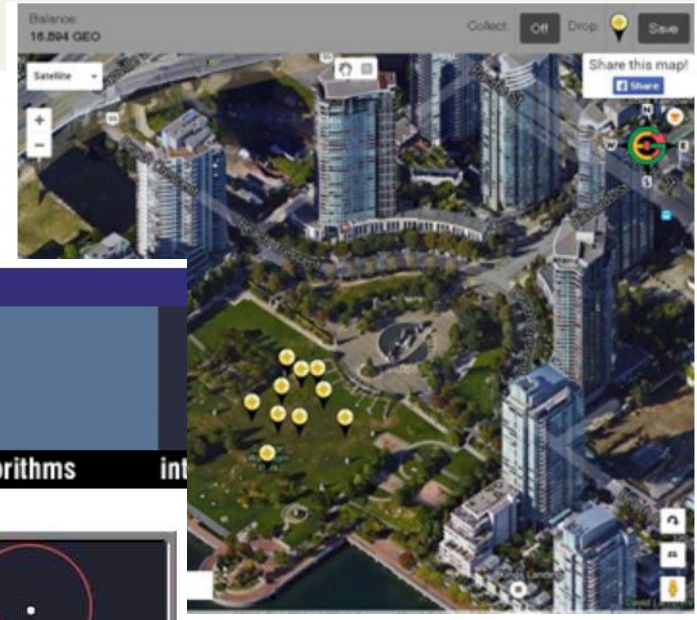
GISTutor.com
(Vancouver)

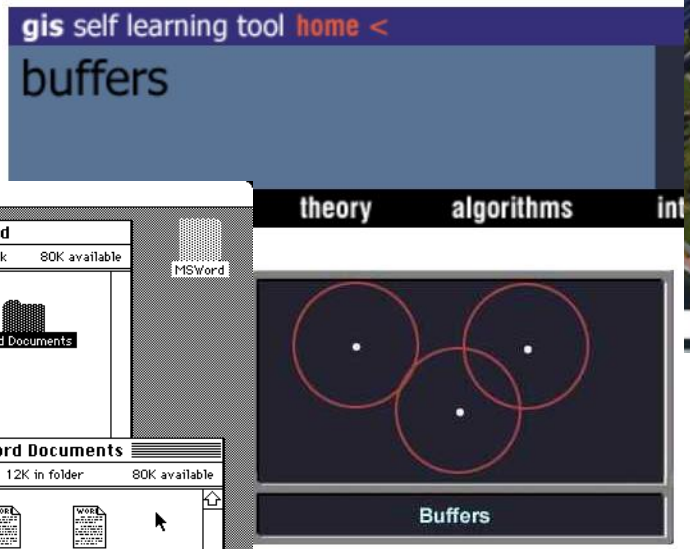
GISWEB

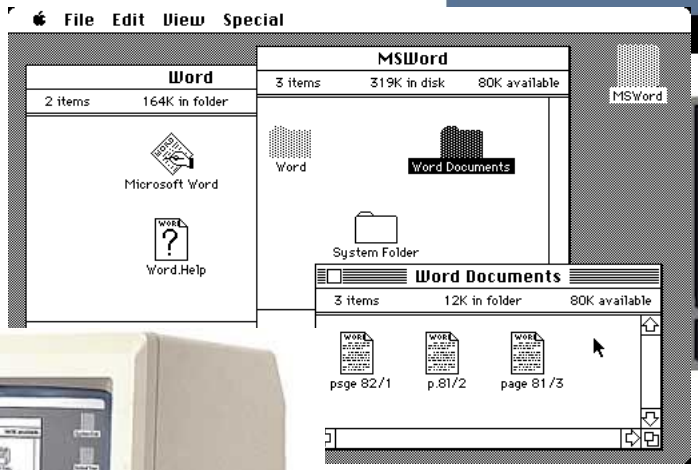
ESRI
Virtual Campus

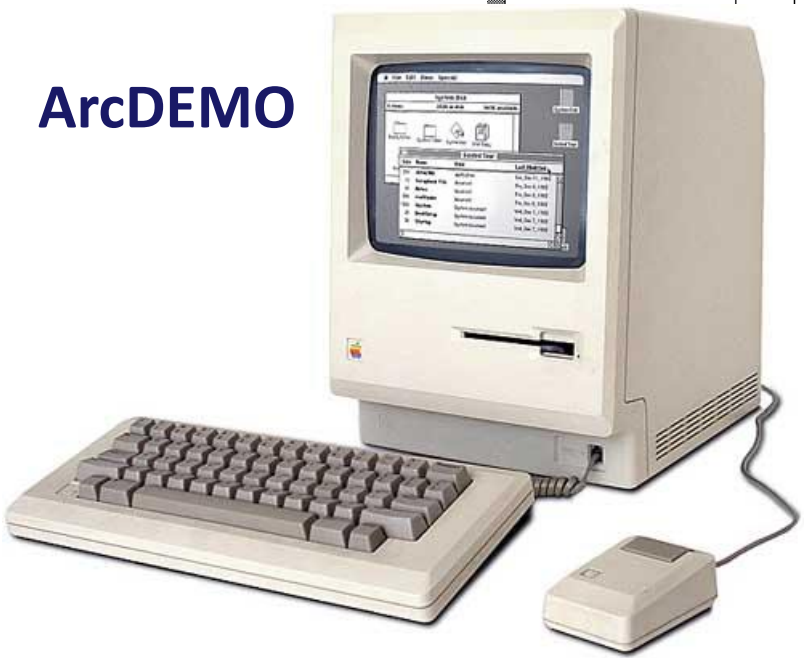
GISTutor

ArcDEMO









Past

Present

GISWEB – a self learning GIS tool

- Origins – The University of Melbourne (1999-2000)
  - Purpose
  - Implementation
  - Content
- The Spanish version – University of Alcalá (2002-2004)
  - Translation
  - Practical modules
  - Evaluation

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GISWEB – context

- At The University of Melbourne GIS attracts students from
  - Geomatics
  - Computer science
  - Archaeology
  - Geography
  - Architecture
  - Earth science
  - …

GISWEB - origins

- Aim

  To enhance, rather than replace, traditional GIS learning models such as lectures, tutorials and practical assignments + Self-paced learning.

  Our expectations:

  - In-lecture tool
  - Improved:
    - Access to learning
    - Productivity
    - Quality of student learning
    - Student attitudes to learning

GISWEB - implementation

Animation

Interactivity

Self evaluation

- Consultation with University of Melbourne's Multimedia Education Unit
- Software adopted
  - Macromedia Director
  - Flash and Shockwave
  - HTML
  - Java scripts

GISWEB - content

- Modules
  - Introduction to geographic information systems
  - Vector overlay processes
  - Raster analysis
  - Terrain analysis
  - Spatial data entry
  - Neighbourhood operations
  - Buffers
  - Line generalisation algorithms

    +
  - Glossary
  - References

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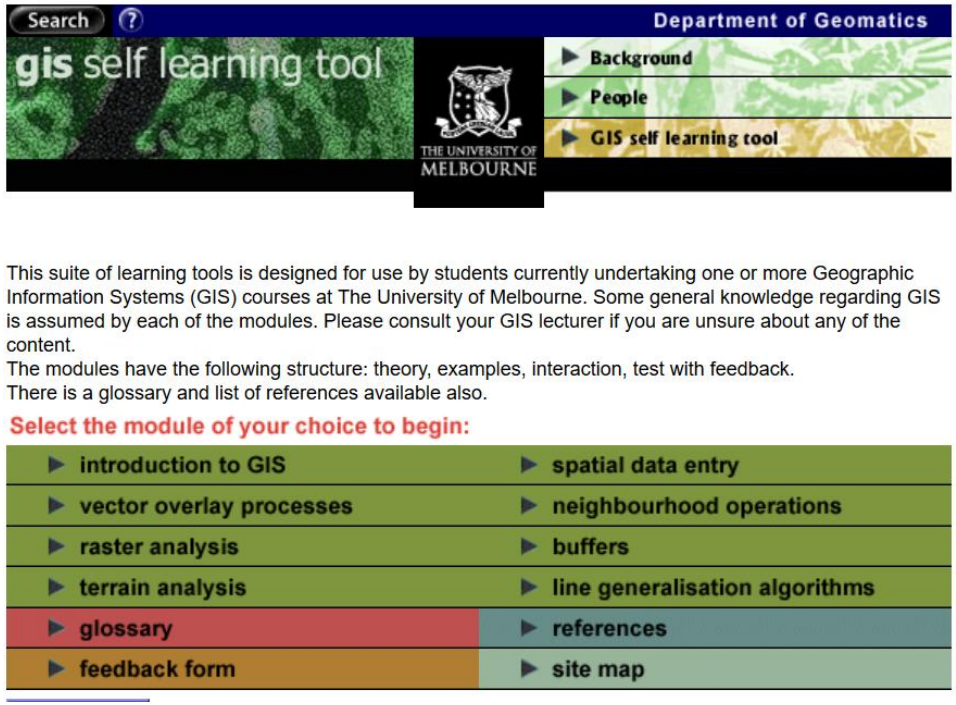

GISWEB - content

- Core GIS concepts with a particular emphasis on spatial algorithms
- Concepts where students experienced difficulties without specific visual or interactive support
- Modules components:
  - Theory
  - Algorithms
  - Worked examples
  - Self-paced revision tests

GISWEB – The Spanish version

- Final year projects
  - 2002:
    - Prototype (2 modules)
    - Evaluation
  - 2004:
    - Full translation
    - Practical exercises
- Usage
  - Env. Sciences
  - Geodetic Engineering
  - Master TIG
  - Latin America

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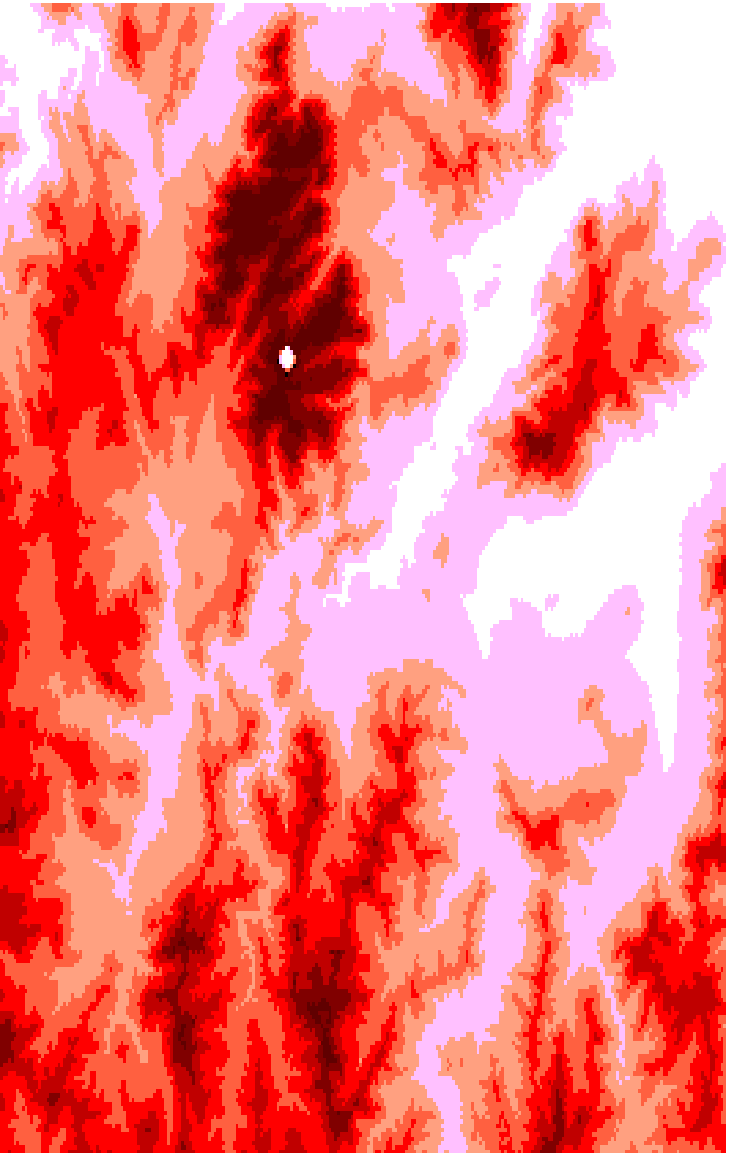
GISWEB – Practical exercises

- ArcGIS – proprietary software
- gvSIG – open (and free) software

GISWEB – Evaluation

- Tool evaluation



	Questions	Response (%)				
		AS	A	N	D	DS
1.	The instructions to use the Neighbourhood Operations site were clear	50	50	0	0	0
2.	The web pages were easy to navigate	39	61	0	0	0
3.	General layout/design of Neighbourhood Operations site was well organised	33	61	6	0	0
4.	The textual information effectively conveyed the concepts and applications of Neighbourhood Operations	28	56	6	11	0
5.	Graphics and animations were effective in illustrating the concepts and applications of Neighbourhood Operations	44	50	6	0	0
6.	Interactivity (user control) was useful for learning the concepts and applications of Neighbourhood Operations	56	39	6	0	0
7.	The 'Questions with Feedback' component was adequate for testing concepts	33	61	6	0	0
8.	The instructions and use of the interactive lessons were clear	39	61	0	0	0
9.	Time needed to load the Shockwave movies (lessons) was acceptable	6	39	44	11	0
10.	The level of detail in the lessons was adequate	6	78	17	0	0
11.	The level of control over the interactive lessons was adequate	33	67	0	0	0
12.	These web pages would help my understanding of Neighbourhood Operations	28	72	0	0	0

KEY

Notes: Agree Strongly (AS); Agree (A); Neutral (N); Disagree (D); Disagree Strongly (DS).
Source: After Nascarella and Urquhart (1999).

GISWEB – Evaluation

- Learning outcomes evaluation

Program	Year	Students	Average age	% women	Previous GIS knowledge
Environmental Sciences	Second	38	19	65.79	Nil (100%)
PhD Geography	First	10	30	64.29	Some (57.14%)
Geodetic Engineering	Fourth and fifth	14	26	56.25	Some (87.5%)

Student group	Number of students GISWEB	Mark obtained in test	Number of students traditional lecture	Mark obtained in test
First year	38	5.5	37	3.5
Engineers	14	7.49	10	7.17
PhD	10	7.3	12	6.3

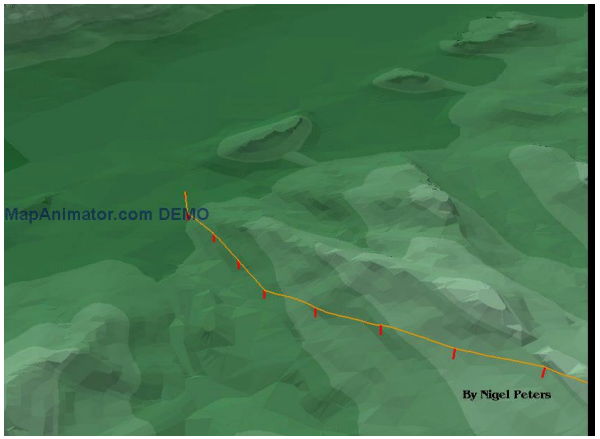
Current resources for GIS teaching and learning

1. Software – availability of free and open source (gvSIG, qGIS…)
2. Availability of online tutorials (youtube and others)
3. Availability of online literature - lecture notes, books, articles…
4. Availability of well documented data – SDI (Copernicus, IGN…)
5. Mobile devices
6. Increased integration of technologies (communications, 3D –CAD-, video editing, multimedia –interactive tools-, virtual and augmented reality…)
7. Social networks and communities (ie tweeter, OpenStreetMaps…)
8. New functionality in Cartography (navigation systems, location based services, early alert systems, games –F1 racing, Pokemon Go… –)

Current resources for GIS teaching and learning

3D visualization exercise

2002



2006

2015

Issues

1. Uncertain value
2. Innovations speed - Obsolescence
3. Digital gap
4. Connection speed (lesser today)
5. Developers skills
6. Costs
7. Ongoing updates and maintenance

GIS competencies in the European Higher Education Area (EHEA)

- Background
- Aim
- Method
- Results
- Discussion

Background

- The European Higher Education Area focus on competencies
- University Consortium for Geographic Information Science (UCGIS) – Curricula
- Geospatial Technology Competency Model – Hierarchized model
- Professional profiles (data analyst, programmer, cartographers…)
- In Spain: White Books (on Geography and Land Planning…)

Aim

Given the new conditions established under the umbrella of the EHEA…

and

The unstructured evolution of the uptake of GIT in tertiary education…

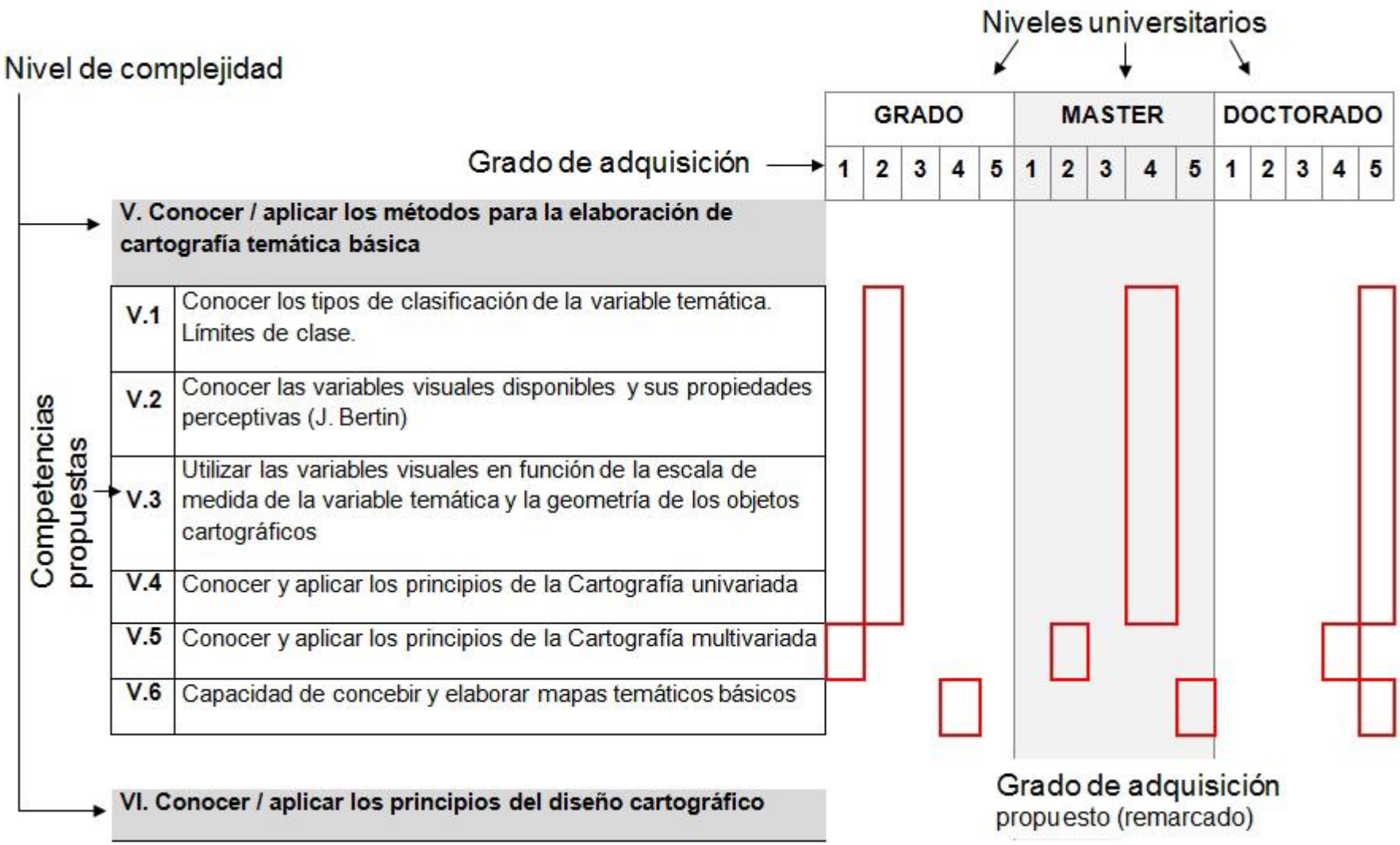
- *…to offer an insight and a proposal for fundamental GIS-related competencies to be considered in tertiary education (Degree, Master and PhD)*

Approach

Participatory

- GITechnologies academic staff at the University of Alcalá (9 full time staff)
  - Three brainstorming sessions
- 200 GITechnologies Spanish academics and professionals
  - Online questionnaire

Results


Niveles universitarios
Nivel de complejidad
GRADO
MASTER
DOCTORADO
Grado de adquisición
1 2 3 4 5 1 2 3 4 5 1 2 3 4 5
V. Conocer / aplicar los métodos para la elaboración de cartografía temática básica
V.1 Conocer los tipos de clasificación de la variable temática. Límites de clase.
V.2 Conocer las variables visuales disponibles y sus propiedades perceptivas (J. Bertin)
V.3 Utilizar las variables visuales en función de la escala de medida de la variable temática y la geometría de los objetos cartográficos
V.4 Conocer y aplicar los principios de la Cartografía univariada
V.5 Conocer y aplicar los principios de la Cartografía multivariada
V.6 Capacidad de concebir y elaborar mapas temáticos básicos
Competencias propuestas
VI. Conocer / aplicar los principios del diseño cartográfico
Grado de adquisición propuesto (remarcado)

Results

		GRADO				
		1	2	3	4	5
I. Definir/identificar componentes y aplicaciones de los SIG						
I.1	Definir los Sistemas de Información Geográfica (SIG) e identificar sus componentes.					
I.2	Conocer los principales hitos de la historia de los SIG.					
I.3	Identificar funciones y campos de aplicación de los SIG.					
I.4	Identificar la naturaleza y las partes de un problema territorial complejo como paso previo a la selección de datos y procedimientos en el SIG.					

Resultado encuesta
Nuestra propuesta

Grado de adquisición

1. *No abordado en este nivel*
2. *Conseguido de forma inicial (fundamentos)*
3. *Conseguido parcialmente (profundización)*
4. *Plenamente conseguido*
5. *Se asume ya conseguido en niveles inferiores*

Discussion

- Further evidences needed
- Discussion forum
- Diversity of users, degrees, backgrounds
- Still… a highly useful exercise
  - Insight on what is taught, when, to whom and for what purpose

Final remarks

- GIS teaching and learning will continue evolving and adopting newer technologies
- What the future of GIS education is going to look like?
  - Divergence (programmers, analysts, users…)
  - Real time, augmented and virtual reality
  - Multisensorial – sound, feel, touch, smell…
  - et...

?

Big thanks to GISWEB people:

Melbourne team

- Ian Bishop
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- Joianna Nascarella
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Alcalá FYP Students

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- Jimena Martínez
- Juan Salinas

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Inmaculada Aguado

Francisco Aguilera

Joaquín Bosque

Emilio Chuvieco

Montserrat Gómez

Javier Salas

M. Jesús Salado

All users around the World

Every colleague who answered the questionnaire

Un grand merci à vous tous pour votre attention