# ESALP 2.0: Educational System to Support Learning of Web Content Accessibility Guidelines by Greek Web Practitioners

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# Introduction (1/3)

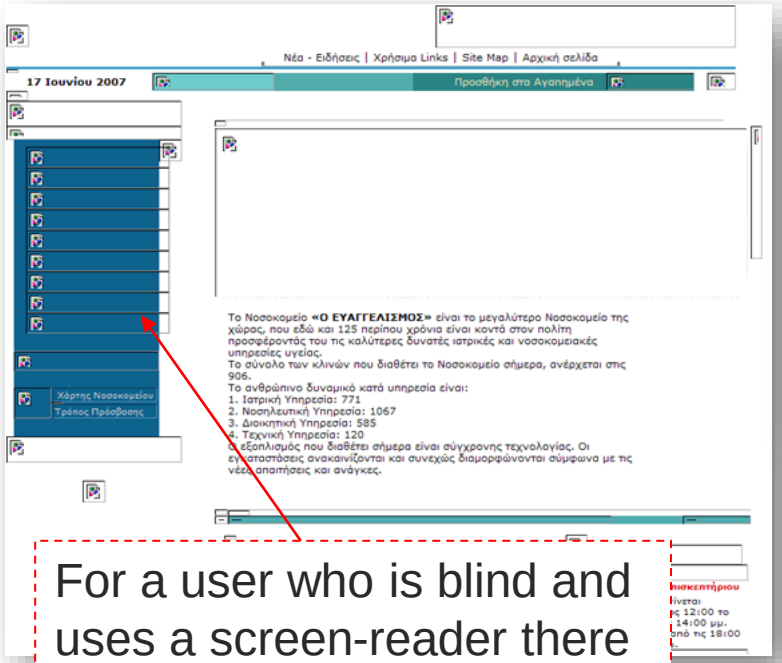
- **Web accessibility**
  - W3C definition: "Websites, tools, and technologies are designed and developed so that people with disabilities can use them. More specifically, people can perceive, understand, navigate, interact with the Web, and contribute to the Web"[1]
  - Refers to the practice of making websites usable by people of all abilities and disabilities
  - Very important topic for the Web (e.g., WAI from W3C)

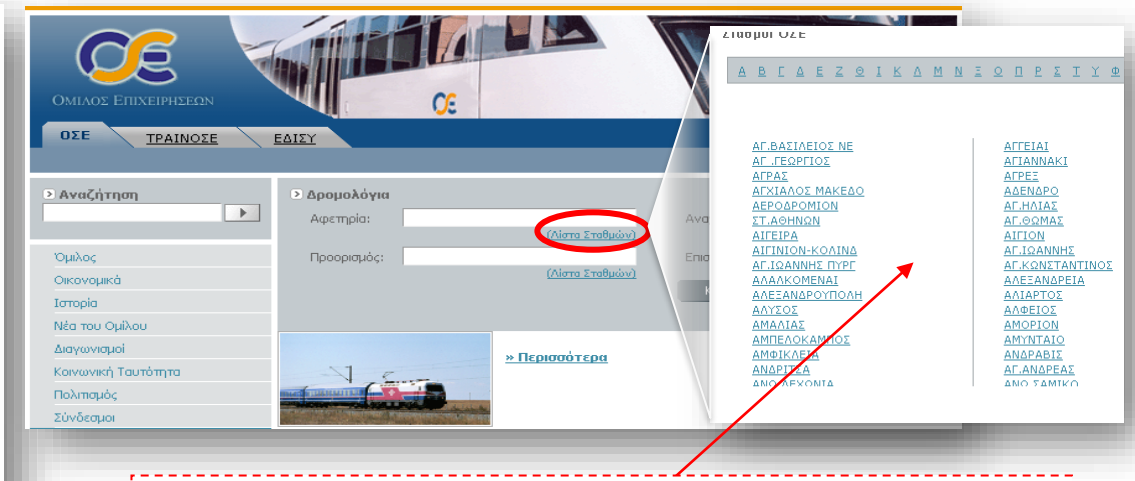
- **How people with disabilities might interact with the Web?[2]**
  - Assistive technologies: e.g., screen reader (blindness), voice recognition (motor disability), head mouse (motor disability)
  - Adaptive strategies: increase font size (low vision), turn on captions (deafness), change website layout (cognitive disability)

[1] W3C. (2005). *Introduction to Web Accessibility*. Web Accessibility Initiative (WAI). https://www.w3.org/WAI/fundamentals/accessibility-intro/
[2] W3C. (2017). *Tools and techniques*. Web Accessibility Initiative (WAI). https://www.w3.org/WAI/people-use-web/tools-techniques/

# Introduction (2/3)

- **How are web developers involved? Examples of problems:**
  - *alt* is non-existent or unhelpful => inaccessible for screen reader user
  - content used only with mouse => inaccessible for keyboard-only user




For a user who is blind and uses a screen-reader there are **no navigation links!!**

For a user with a motor disability that can't use pointing devices **it is impossible to choose stations** in this window that does not allow use of keyboard keys.

# Introduction (3/3)

- **How to develop accessible websites?**
  - Key knowledge comes in the form of accessibility guidelines
  - Web Content Accessibility Guidelines (WCAG) is the most popular set
  - WCAG structure: Principles > Guidelines > Success criteria (3 priorities)
- **Studies in various domains report websites being inaccessible**
  - Government websites [1-4]
  - University websites[5-8]
  - Websites of libraries[9]
  - Commercial websites[10]


[1] Al-Khalifa, H. S. (2012). The accessibility of Saudi Arabia government Web sites: An exploratory study. *UAIS*, *11*(2), 201–210.
[2] Bakhsh, M., & Mehmood, A. (2012). Web accessibility for disabled: A case study of government websites in Pakistan. *FIT 2012*, 342–347.
[3] Baowaly, M. K., & Bhuiyan, M. (2012). Accessibility analysis and evaluation of Bangladesh government websites. *ICIEV 2012*, 46–51.
[4] Gambino, O., Pirrone, R., & Giorgio, F. D. (2016). Accessibility of the Italian institutional web pages: A survey on the compliance of the Italian public administration web pages to the Stanca Act and its 22 technical requirements for web accessibility. *UAIS*, *15*(2), 305–312.
[5] Akritidis, G., & Katsanos, C. (2021). Effect of potential issues flagged by automated tools on web accessibility evaluation results: A case study on university department websites. *PCI 2021*, 113–117.
[6] Campoverde-Molina, M., Luján-Mora, S., & Valverde, L. (2023). Accessibility of university websites worldwide: A systematic literature review. *UAIS*, *22*(1), 133–168.
[7] Laufer Nir, H., & Rimmerman, A. (2018). Evaluation of web content accessibility in an Israeli institution of higher education. *UAIS*, *17*(3), 663–673.
[8] Verkijika, S. F., & De Wet, L. (2020). Accessibility of South African university websites. *UAIS*, *19*(1), 201–210.
[9] Panda, S., & Chakravarty, R. (2020). Evaluating the web accessibility of IIT libraries: A study of Web Content Accessibility Guidelines. *Perform. Meas. Metr.*, *21*(3), 121–145.
[10] Isa, W. A. R. W. M., Aziz, M. A., & Razak, M. R. B. A. (2011). Evaluating the accessibility of Small and Medium Enterprise (SME) websites in Malaysia. *i-USEr 2011,* 135–140.

# Research motivation and goal

- **Research motivation**
  - Websites remain largely inaccessible
  - "Lack of developers' training, lack of managerial support, lack of client support and confusing guidelines" (study with 175 webmasters)[1]
  - Guidelines criticized that they “are nearly impossible for a working standards-compliant developer to understand”[2]
- **Research goal**
  - Increase awareness, motivate and educate web development stakeholders in Greece on web accessibility and WCAG 2
  - We present ESALP 2.0 (Educational System for Accessibility Learning Through Paradigms), a learn-by-example online tool

[1] Lazar, J., Dudley-Sponaugle, A., & Greenidge, K.-D. (2004). Improving web accessibility: A study of webmaster perceptions. *CHB*, *20*(2), 269–288.
[2] Clark, J. (2006). *To Hell with WCAG 2*. A List Apart. https://alistapart.com/article/tohellwithwcag2/

# ESALP 2.0: Overview

- **Goals**
  - Train web practitioners on good accessibility practices and WCAG 2
  - Communicate the value of accessibility to stakeholders
- **How?**
  - Expose people to real-world accessibility problems that occur when certain WCAG 2 guidelines are violated
  - Provide concise advice on how to resolve and avoid such problems
- **Use cases**
  - Web practitioner uses ESALP 2.0 to
    - learn how to develop accessible websites using WCAG 2.0
    - communicate the need for accessibility to other stakeholders (e.g., clients, managers)
  - Professor/Educator uses ESALP 2.0 in a relevant context (e.g., course, seminars, summer school)

# ESALP 2.0: Finding real-world examples of guidelines violations

- **Accessibility evaluation study**
  - 70 Greek websites selected from 7 different domains
  - Evaluated against WCAG 2.0 AAA
  - Multiple tools used for automated analysis (Achecker, Tenon, Sortsite)
  - Manual inspection
    - Verify selected issues from auto-analysis
    - Find issues for criteria not covered by auto-analysis

| Domain | # of sites | Example of evaluated website |
|---|---|---|
| **Public & utility services** | 10 | Greek parliament (https://www.hellenicparliament.gr) |
| **Local government** | 10 | Municipality of Athens (https://www.cityofathens.gr) |
| **Education** | 10 | National and Kapodistrian University of Athens (https://www.uoa.gr) |
| **Health** | 10 | General Hospital of Athens Evangelismos (https://evaggelismos-hosp.gr) |
| **Culture & Tourism** | 10 | National Theatre of Greece (https://n-t.gr) |
| **News** | 10 | Hellenic Broadcasting Corporation (https://www.ert.gr) |
| **E-commerce** | 10 | Skroutz (https://www.skroutz.gr) |

# ESALP 2.0: Success criterion webpage (1/2)

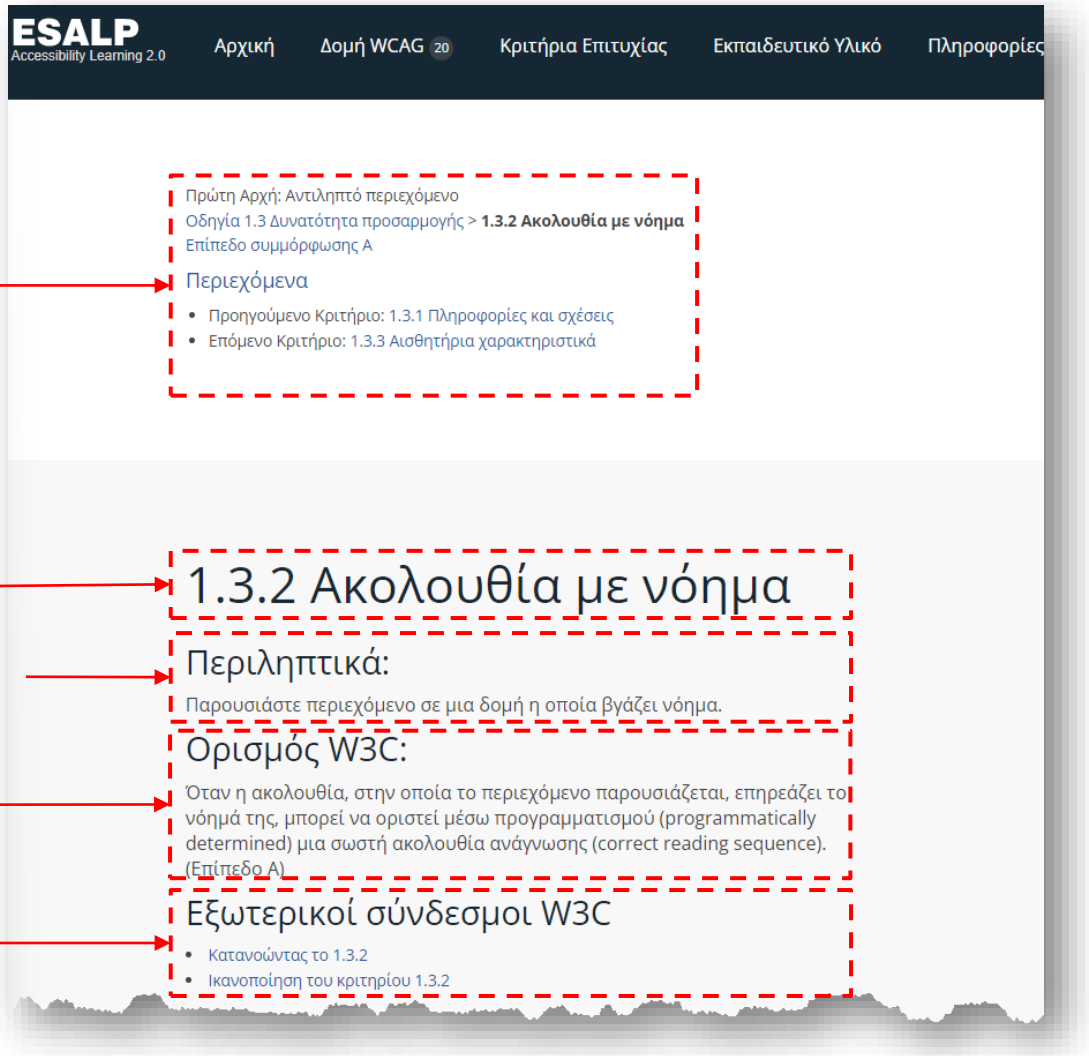
Navigation tools (breadcrumbs, list of all criterion pages, previous & next criterion page)

Criterion name

In a nutshell description

W3C definition

External links to associated W3C webpages




http://esalp2.rf.gd/sc1-3-2.html

# ESALP 2.0: Success criterion webpage (2/2)

Metadata for the example (website name & domain, evaluation date)

Accessibility problem description (text & image)

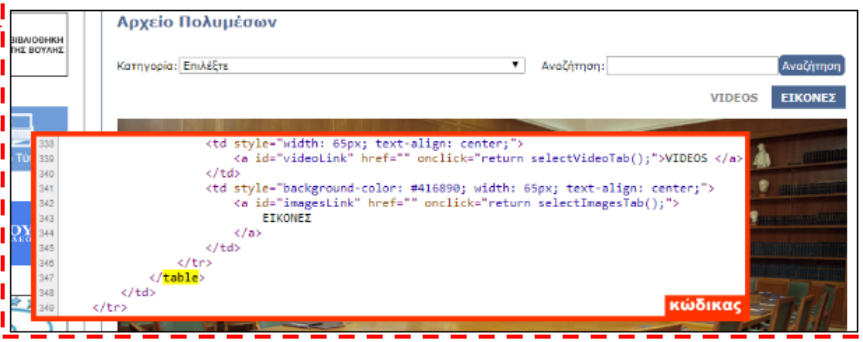
Succinct guidance on how to avoid or resolve the problem

## Παράδειγμα 1

*Ιστοσελίδα:* Βουλή των Ελλήνων
*Κατηγορία:* Δημόσιες & κοινωφελείς υπηρεσίες
*Ανάκτηση:* 16/07/2018

### Πρόβλημα:

Στη σελίδα με τίτλο «Αρχείο Πολυμέσων», χρησιμοποιείται πίνακας δίχως τιμές δεδομένων (data), για τη διαμόρφωση της εμφάνισης του αρχείου πολυμέσων. Καθώς το πλάτος των γραμμών είναι μηδενικό, οπτικά ένας χρήστης δεν καταλαβαίνει την ύπαρξη του πίνακα. Ένας αναγνώστης οθόνης όμως, θα διαβάσει τον πίνακα, ενημερώνοντας αρχικώς για τον αριθμό γραμμών και στηλών, στις οποίες ο χρήστης με προβλήματα όρασης θα προσπαθήσει να περιηγηθεί, διαβάζοντας τον πίνακα γραμμή - γραμμή.




### Μία λύση στο πρόβλημα:

Γενικώς οι πίνακες σε μια ιστοσελίδα πρέπει να αφορούν παρουσίαση δεδομένων και να μη χρησιμοποιούνται για λόγους διαμόρφωσης της εμφάνισης. Θα πρέπει το συγκεκριμένο τμήμα να ξανασχεδιαστεί με τη χρήση CSS το οποίο ενδείκνυται για το σκοπό αυτό.

http://esalp2.rf.gd/sc1-3-2.html

# ESALP 2.0: Grouped per WCAG 2 priority and principle & guideline

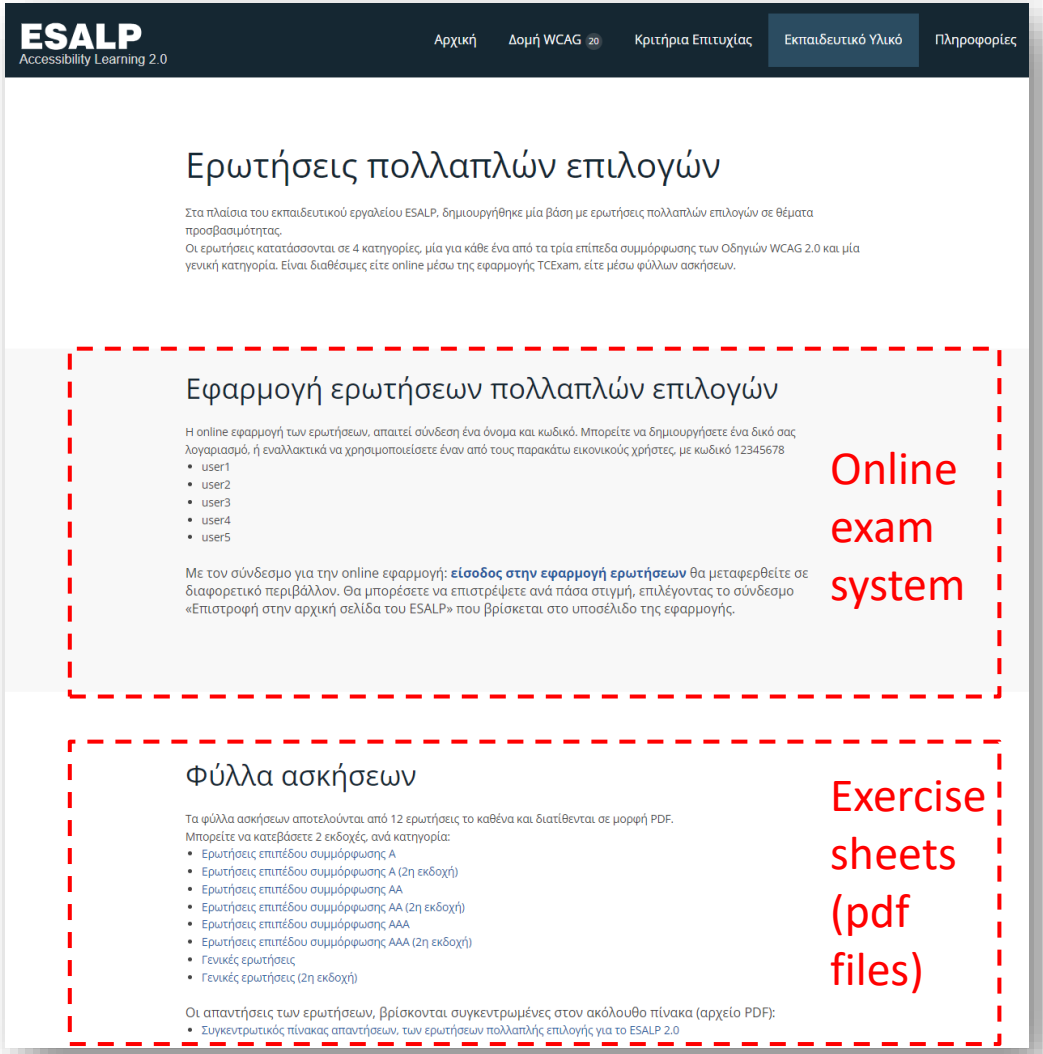
Grouped per WCAG 2 priority level

Grouped per WCAG 2 principle & guideline


http://esalp2.rf.gd/wcag.html

# ESALP 2.0: Test quizzes

- **Test bank**
  - 90 multiple choice questions
    - 28 for A priority
    - 14 for AA priority
    - 25 for AAA priority
    - 24 for general accessibility issues or multiple priority levels
  - Available through:
    - An online exam system (TCExam)
    - Exercise sheets (pdf files)




http://esalp2.rf.gd/edu.html

# Evaluation study: Goal and Methodology

- **Goal**
  - Investigate the usability of ESALP 2.0
- **Methodology**
  - Participants: 12 web developers
  - Procedures
    - Remote user testing
    - Users interacted with the tool (free exploration)
    - Users completed online questionnaire (post-session)
  - Questionnaire
    - Filter question (excluded 7 users that did not select "web developer")
    - Greek version of System Usability Scale (SUS)[1]
    - Three open-ended questions on ESALP 2.0: 3 most positive characteristics, 3 changes to improve UX, any other comments for the tool

[1] Orfanou, K., Tselios, N., & Katsanos, C. (2015). Perceived usability evaluation of learning management systems: Empirical evaluation of the System Usability Scale. *IRRODL*, 16(2), 227–246.
[2] Katsanos, C., Tselios, N., & Xenos, M. (2012). Perceived usability evaluation of learning management systems: A first step towards standardization of the System Usability Scale in Greek. *PCI 2012*, 302–307.

# Evaluation study: Results

- **Quantitative**
  - Perceived usability of ESALP 2.0 was measured with SUS
  - ESALP 2.0 SUS score: M=81.5, SD=13.7, 95% C.I.=[72.7-90.2]
  - ESALP 2.0 rated as “Good to Excellent” (Good=71.4, Excellent=85.5)[1]
- **Qualitative**
  - 13 user comments
  - Inductive content analysis

| Category | Sub-category | Count | Example of comment |
|---|---|---|---|
| **Positive ESALP 2.0 user experience** | Useful tool overall | 5 | “It provides essential knowledge for web developers as well as useful knowledge for any web user” |
| | Examples of violations make guidelines easy to understand | 4 | “I liked the counterexamples provided: ways of poor or non-application of the guidelines” |
| | Usable and easy to use | 3 | “I found it simple, fast and usable” |
| | Good exercises for practice | 1 | “I liked the exercises with the test questions that are available for practice” |
| **Suggestions to improve ESALP 2.0 user experience** | Add search functionality | 2 | “Add search to the training material” |
| | Add examples of conformance to the guideline | 1 | “It would be nice to have some videos demonstrating with examples the right and wrong practices for accessibility” |
| | Use videos for the guideline violations | 1 | “It would be nice to have some videos demonstrating with examples the right and wrong practices for accessibility” |
| | Add more exercises for practice | 1 | "Maybe enriching it with more practice exercises is the next important step" |
| | Give certificates of completion | 1 | “After completing the tests, certificates of successful completion should be issued.” |



[1] Bangor, A., Kortum, P., & Miller, J. (2009). Determining what individual SUS Scores mean: Adding an adjective rating scale. *JUS*, *4*(3), 114–123.

# Future directions

- **Address user comments** from first user testing study
  - Add search functionality
  - Add examples of conformance to each WCAG criterion (not only violations)
  - Implement MOOC around the content of the tool and provide certificates of completion after an examination procedure

- New study with **a larger number of participants** to investigate ESALP 2.0 **usability and learning effectiveness** (pretest-posttest design)

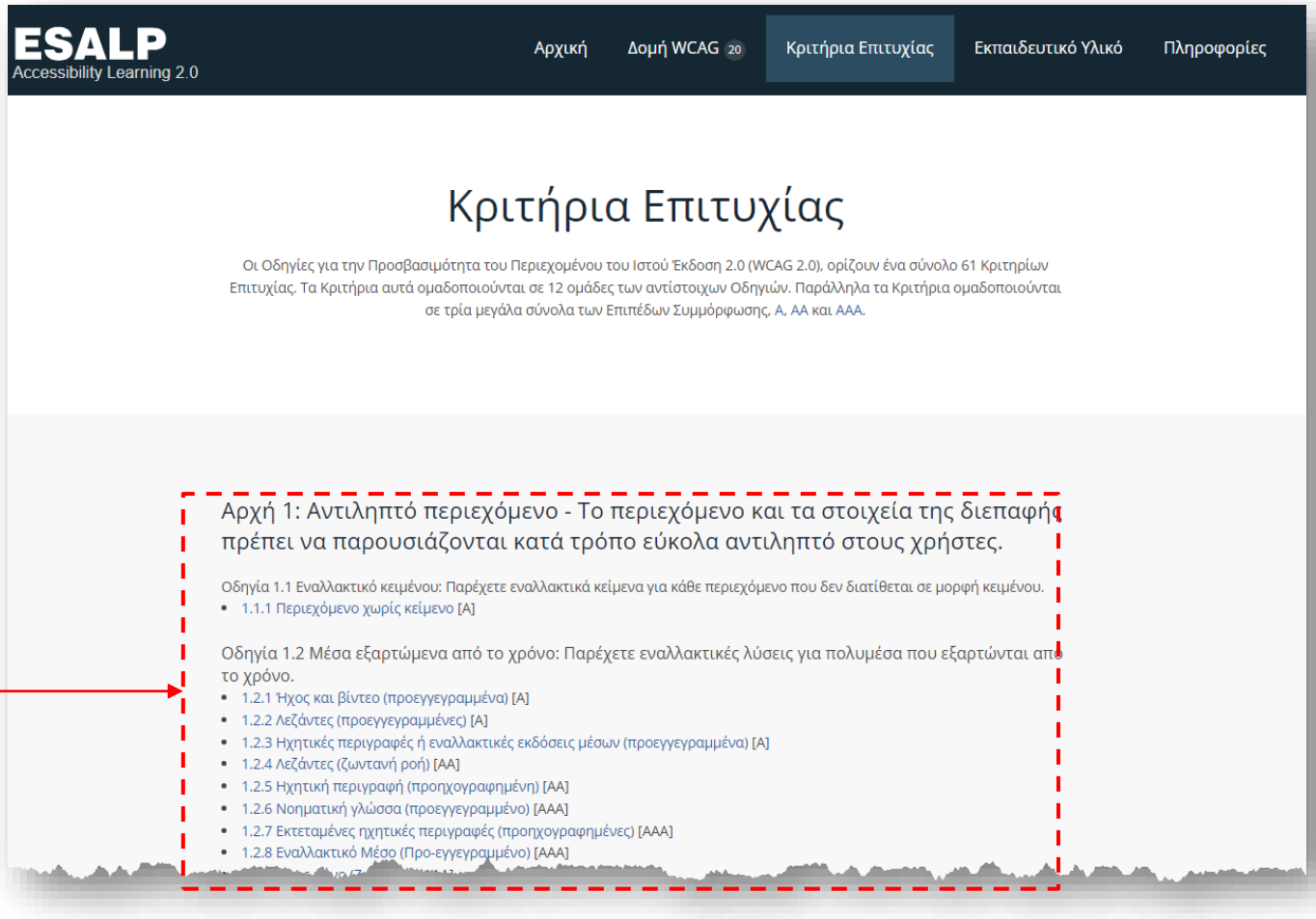
# Summary & Questions

- **Summary**
  - We presented the ESALP 2.0 tool to increase awareness, motivate and educate web development stakeholders on web accessibility
  - The tool uses examples of real-world WCAG violations based on an accessibility evaluation study of 70 Greek websites
  - ESALP 2.0 also provides opportunities to exercise the obtained knowledge by answering multiple choice questions
  - A user testing study with web developers found that ESALP 2.0 is usable and collected qualitative insights to further improve it
- **Questions?**
  - Shoot!
- **More questions and not enough time! No worries ☺**
  - Christos Katsanos (ckatsanos@csd.auth.gr)

# Backup/Extra slides

# ESALP 2.0: List of all criteria grouped per WCAG 2 principle & guideline

List of all criteria grouped per WCAG 2 principle & guideline




http://esalp2.rf.gd/successcriteria.html

# ESALP 2.0 vs. ESALP 1.0

- **ESALP 2.0 extends are previous work on ESALP 1.0[1,2] in three ways**
  - ESALP 2.0 uses the WCAG 2.0 version instead of the WCAG 1.0 one
  - New accessibility evaluation study of 70 Greek websites to produce the real-world examples of violations included in ESALP 2.0
  - ESALP 2.0 offers test quizzes so that the learners can self-evaluate their knowledge on web accessibility

[1] Katsanos, C., Tsakoumis, A., & Avouris, N. (2009). Web accessibility: Design of an educational system to support guidelines learning. *PCI 2009*, 155–164.
[2] Katsanos, C., Tselios, N., Tsakoumis, A., & Avouris, N. (2012). Learning about web accessibility: A project based tool-mediated approach. *Educ. Inf. Technol., 17*(1), 79–94.