The evolution of learning media

From slides to books and the web into the metaverse

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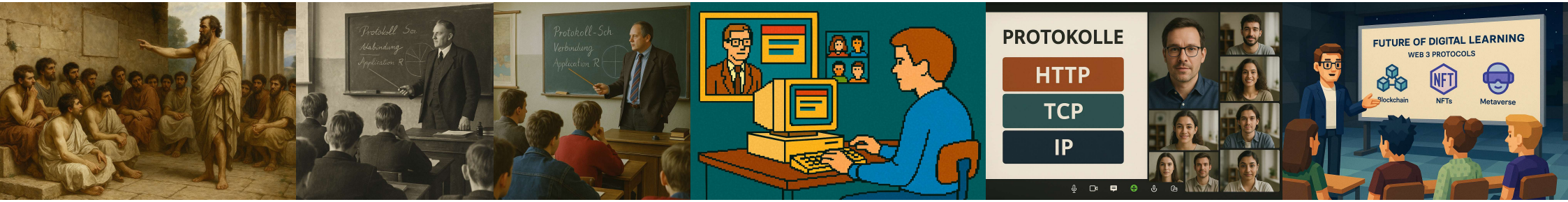
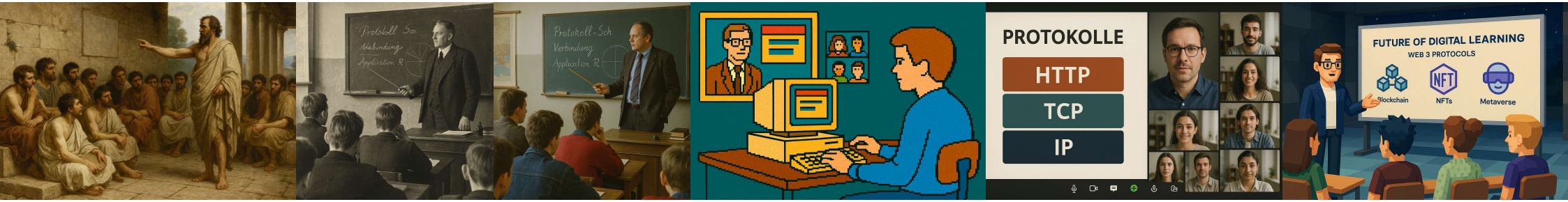
Austria

WhoAmI? WhoAreWe?



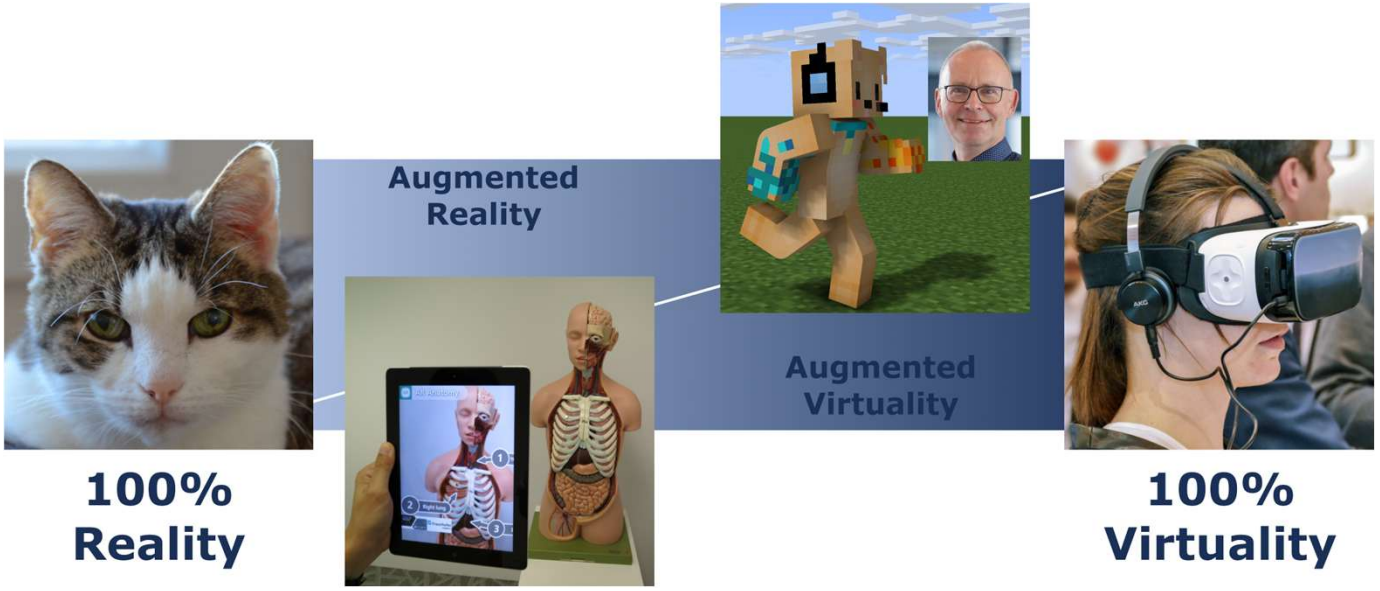
… the evolution of learning situations

The evolution of learning media …

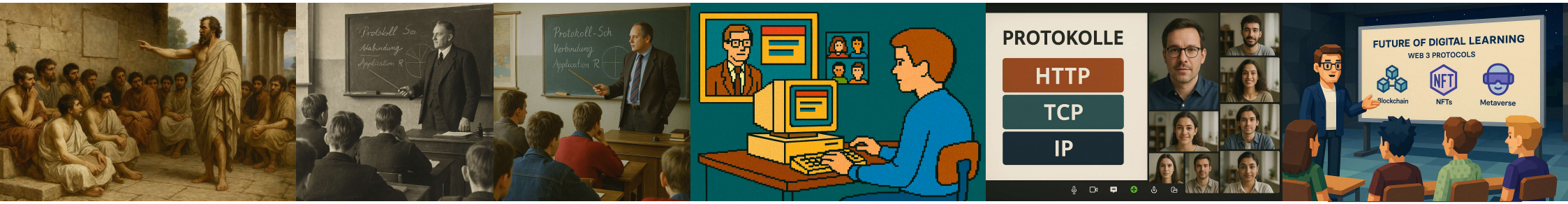


… the evolution of learning situations

The evolution of learning media



Reality-Virtuality-Continuum
(Milgram & Kishino, 1994)



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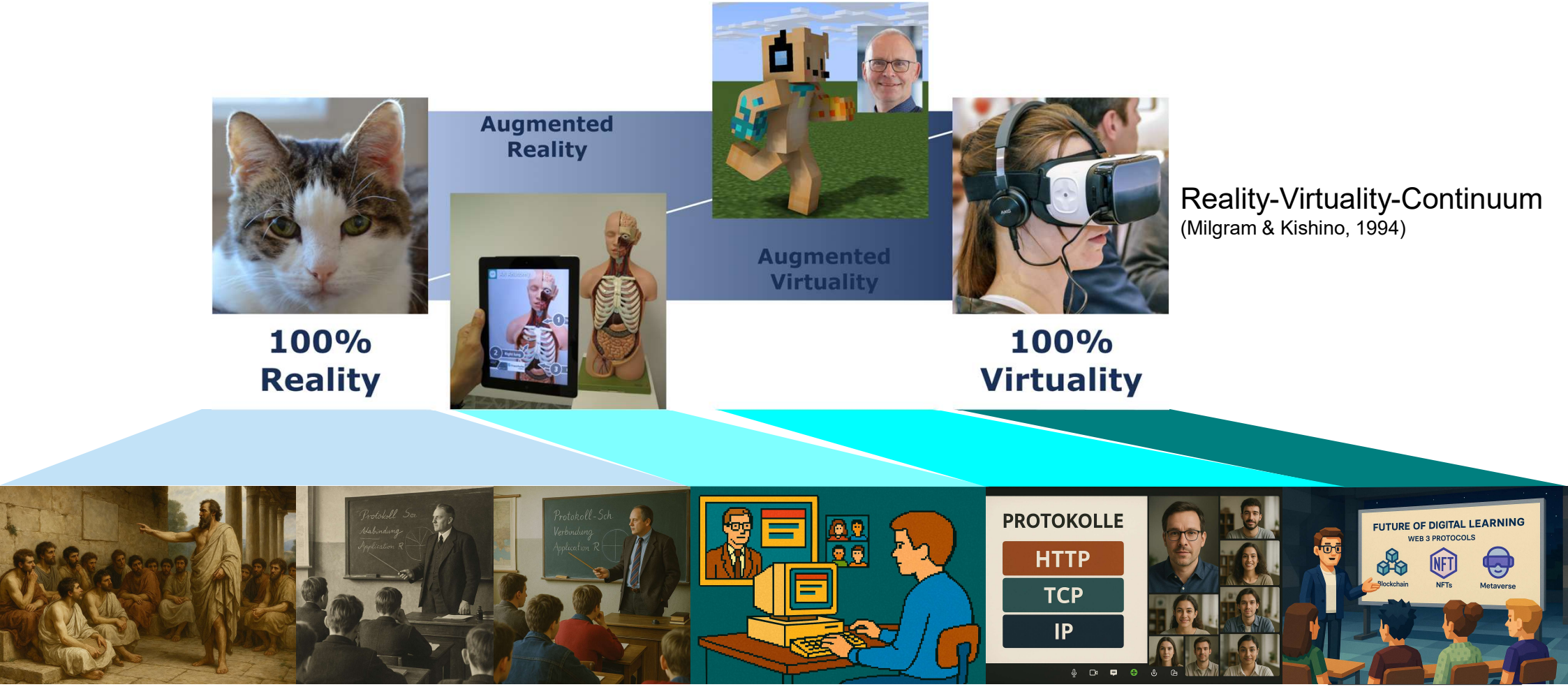
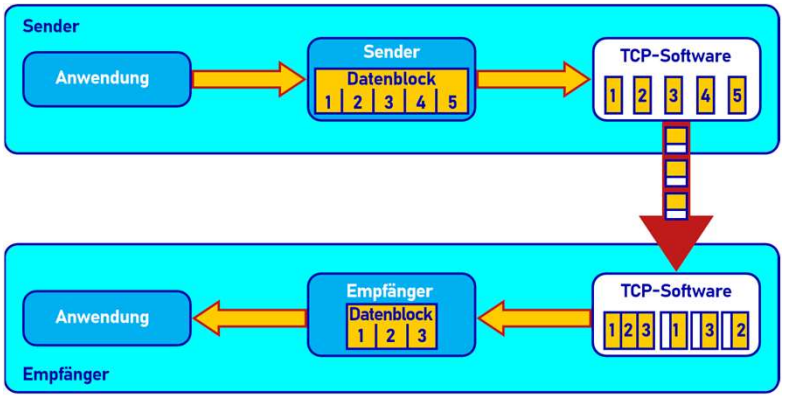
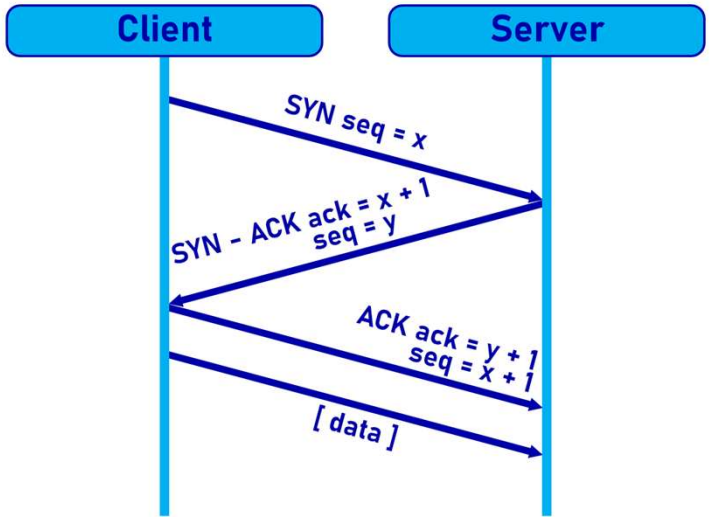


Reality-Virtuality-Continuum
(Milgram & Kishino, 1994)

FHV Dornbirn, Austria
~1600 Students
~ 260 Students in Computer Science
~ 100 Students with Computer Sciences in their curricula

FOM, Munich, Germany
~5.150 Students
~ 750 Students in Computer Science





Challenge: Abstract content !

→ difficult to convey via linear formats
→ didactic limits of classic lectures with slides

→ The role of media AND interaction as carriers and supporters of didactic intentions is central !

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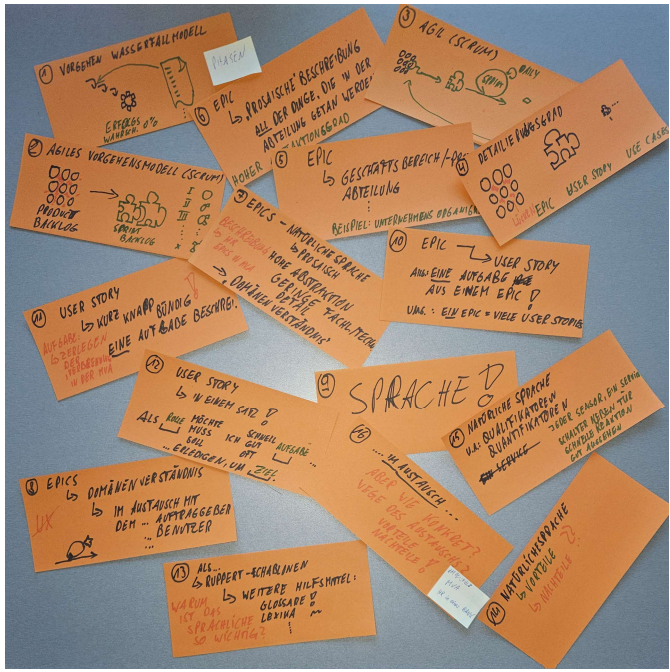
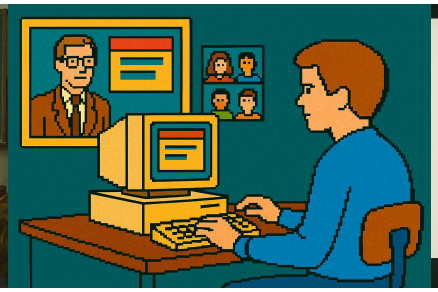
Evolution Step 0: Slides & Dialog Cards & Blackboard

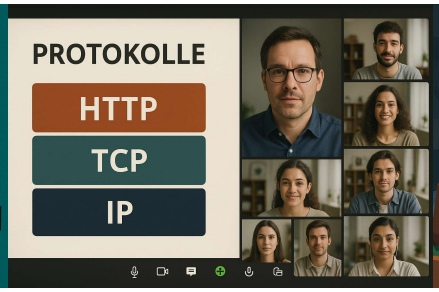


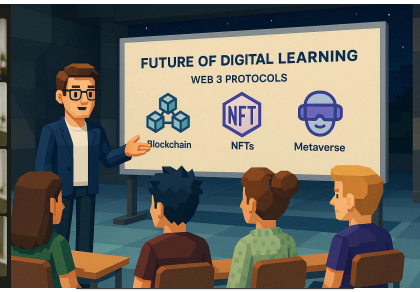
Characteristic:
- → classical frontal teaching
- → linear structure
- → order by the lecturer
  - → “follow the lecturer”

Strengths: → simple, clear, standardized

Weaknesses: → receptive, less interactivity







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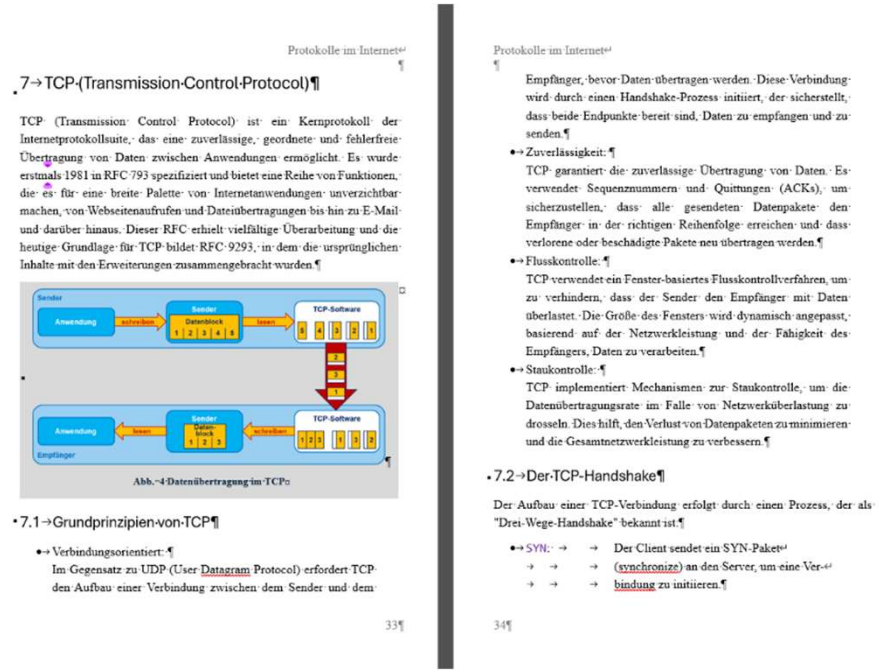
Evolution Step 1: Textbook

Characteristic:
- → linear structure
- → self-study
  - → individual order and speed

Strengths:
- → in-depth study, kind of a reference book

Weaknesses:
- → text-heavy, lacking visual elements,
- → no interactivity
- → somehow “inappropriate” for computer science students



Protokolle im Internet

7 TCP (Transmission Control Protocol)

TCP (Transmission Control Protocol) ist ein Kernprotokoll der Internetprotokollsuite, das eine zuverlässige, geordnete und fehlerfreie Übertragung von Daten zwischen Anwendungen ermöglicht. Es wurde erstmals 1981 in RFC 793 spezifiziert und bietet eine Reihe von Funktionen, die es für eine breite Palette von Internetanwendungen unverzichtbar machen, von Webseitenaufrufen und Dateiübertragungen bis hin zu E-Mail und darüber hinaus. Dieser RFC erhielt vielfältige Überarbeitung und die heutige Grundlage für TCP bildet RFC 9293, in dem die ursprünglichen Inhalte mit den Erweiterungen zusammengebracht wurden.

Abb. 4 Datenübertragung im TCP

7.1 Grundprinzipien von TCP

- Verbindungsorientiert:
  Im Gegensatz zu UDP (User Datagram Protocol) erfordert TCP den Aufbau einer Verbindung zwischen dem Sender und dem

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Protokolle im Internet

Empfänger, bevor Daten übertragen werden. Diese Verbindung wird durch einen Handshake-Prozess initiiert, der sicherstellt, dass beide Endpunkte bereit sind, Daten zu empfangen und zu senden.

- Zuverlässigkeit:
  TCP garantiert die zuverlässige Übertragung von Daten. Es verwendet Sequenznummern und Quittungen (ACKs), um sicherzustellen, dass alle gesendeten Datenpakete den Empfänger in der richtigen Reihenfolge erreichen und dass verlorene oder beschädigte Pakete neu übertragen werden.
- Flusskontrolle:
  TCP verwendet ein Fenster-basiertes Flusskontrollverfahren, um zu verhindern, dass der Sender den Empfänger mit Daten überlastet. Die Größe des Fensters wird dynamisch angepasst, basierend auf der Netzwerkleistung und der Fähigkeit des Empfängers, Daten zu verarbeiten.
- Staukontrolle:
  TCP implementiert Mechanismen zur Staukontrolle, um die Datenübertragungsrate im Falle von Netzwerküberlastung zu drosseln. Dies hilft, den Verlust von Datenpaketen zu minimieren und die Gesamtnetzwerkleistung zu verbessern.

7.2 Der TCP-Handshake

Der Aufbau einer TCP-Verbindung erfolgt durch einen Prozess, der als "Drei-Wege-Handshake" bekannt ist.

- SYN: → Der Client sendet ein SYN-Paket (synchronize) an den Server, um eine Verbindung zu initiieren.

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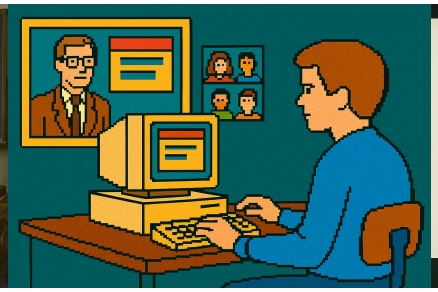
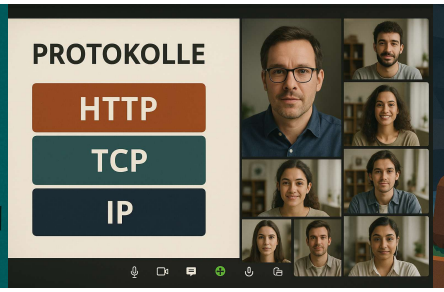
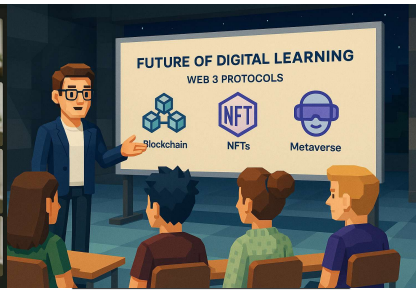






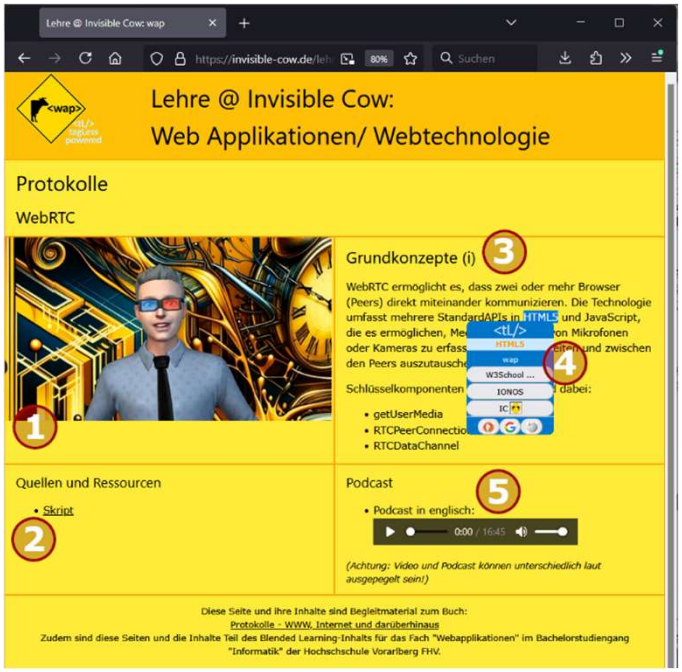
The evolution of learning media

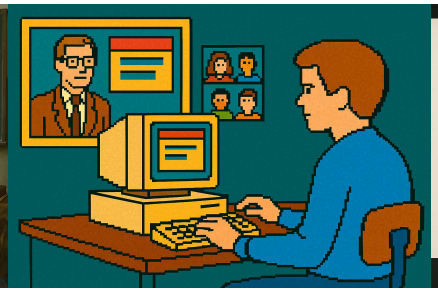
Evolution Step 2: Interactive Web Page

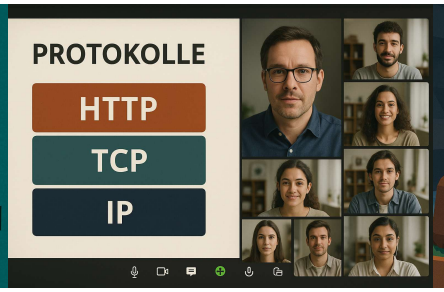
Characteristic:
- → non-linear structure
- → self-study
  - → individual order and speed

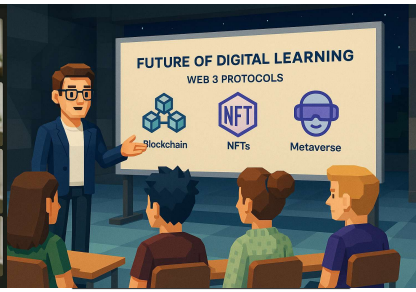
Strengths:
- → multimedia
- → highly interactive
- → transparency (open scripts)

Weaknesses:
- → design and media overload
- → usability issues (new ways of interaction)









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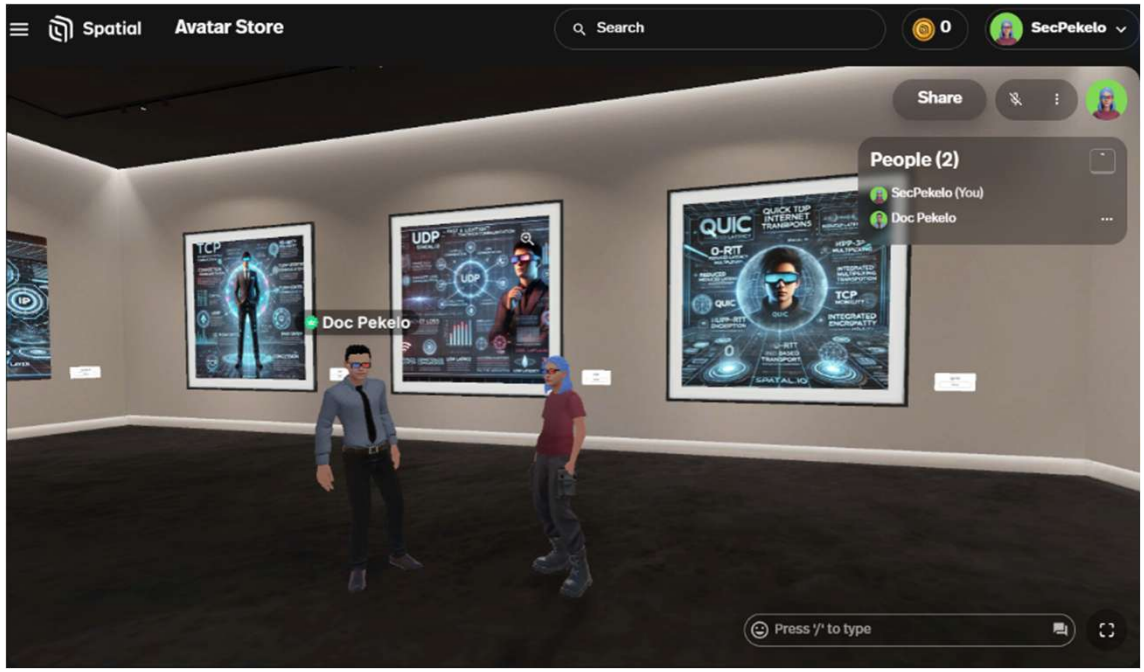
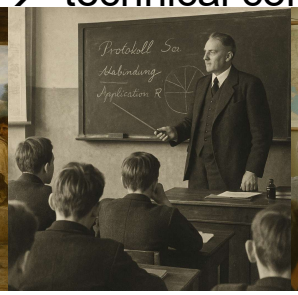
Evolution Step 3: Immersive Space in the Metaverse

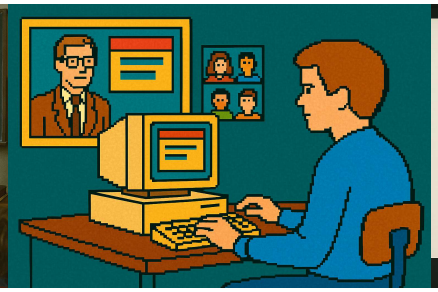
Characteristic:
- → non-linear structure
- → self-study
  - → collaboration and exploration with individual avatars

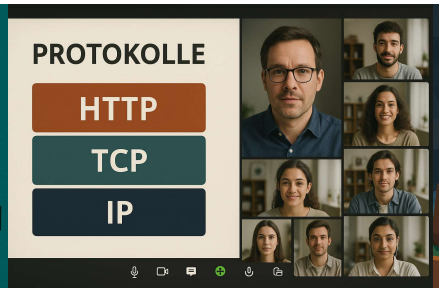
Strengths:
- → motivation
- → social dimension
- → immersive experience

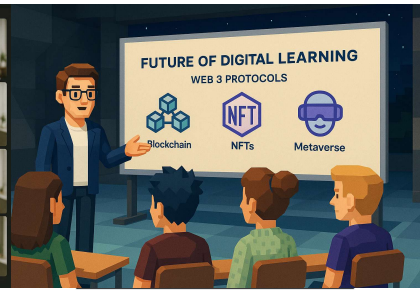
Weaknesses:
- → Open questions regarding learning success
- → technical complex











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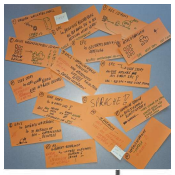
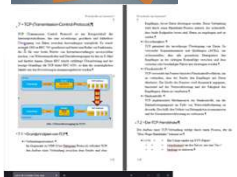
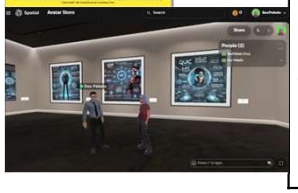
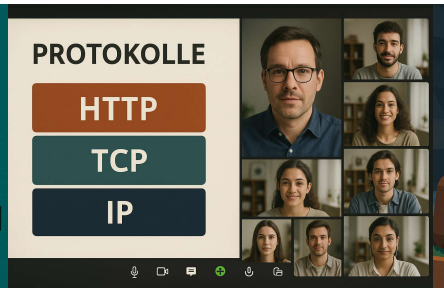
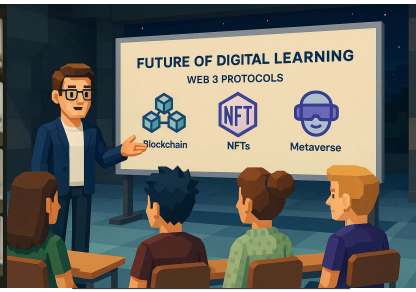






Step 0 **Slides & Dialog Cards & Blackboard**	• Linear slide presentation • Frontal teaching • Interaction only occasionally	• Simple structuring • Direct presentation by teachers	• Highly receptive • Little activating • Limited visualization options • Low motivation
Step 1 **Textbook**	• Classic textbook • Systematically structured • Supplementary to lectures	• In-depth presentation • Time and location independent learning • Documentation and reference function	• Static, text-heavy • Hardly related to practical applications • Overwhelming due to a lot of text • Low interactivity
Step 2 **Interactive Web Page**	• Videos with avatars • Hypertext Navigation • Subtitles, Scripts, Open Code • Self-tests as Quizzes (KPRIM)	• Increased interactivity • Media fit for digital topics • Transparency through open scripts • Motivation to self-directed learning	• Partially confusing design (Interaction) Aesthetics ;) • Design crucial for acceptance
Step 3 **Immersive Space**	• Immersive 3D environment (Spatial.io) • Avatars for Social Interaction, individual exploration & collaboration	• High motivation & strong involvement • Social and emotional dimension • Exploratory, situational learning possible • Low-threshold access (browser based)	• Quiz integration not yet possible • Didactic added value compared to the web still unclear • High design effort • Open questions about sustainability and learning success





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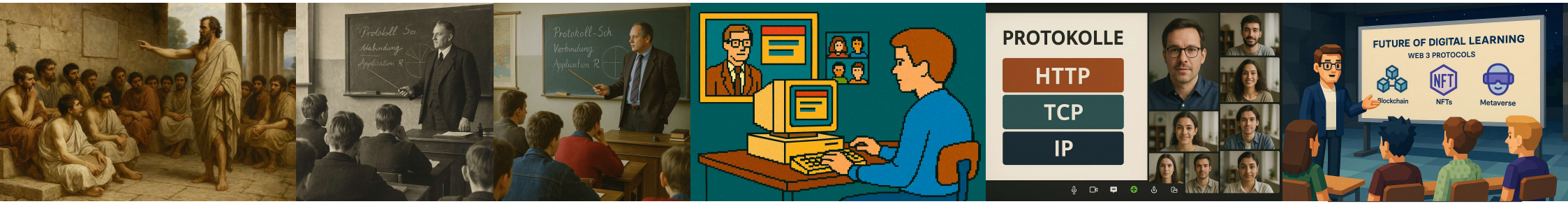
Why do I not show absolute numbers ?

→ At least one main reason: it was all „my students“

→ Number of students (and especially the number of answered questionnaires) is too small for a general scientific statement

→ Broader studies with more participating students are necessary



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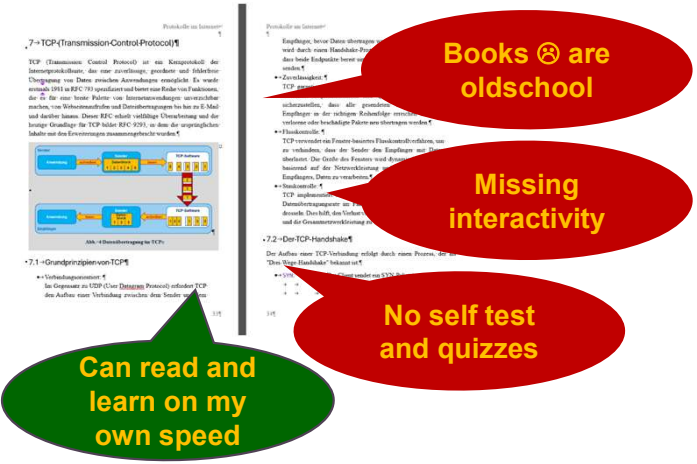

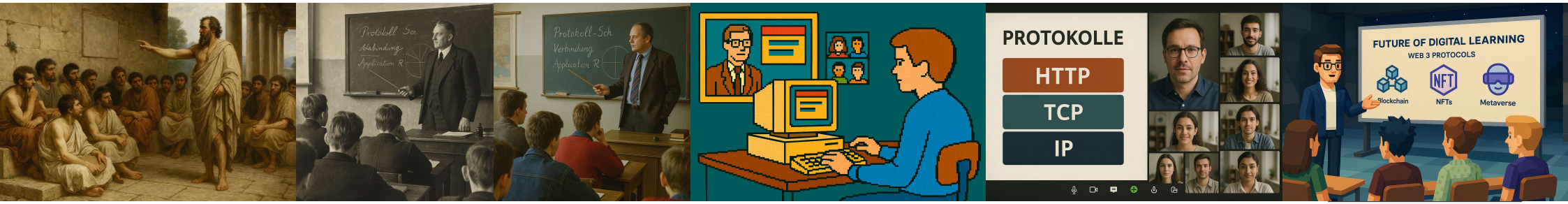

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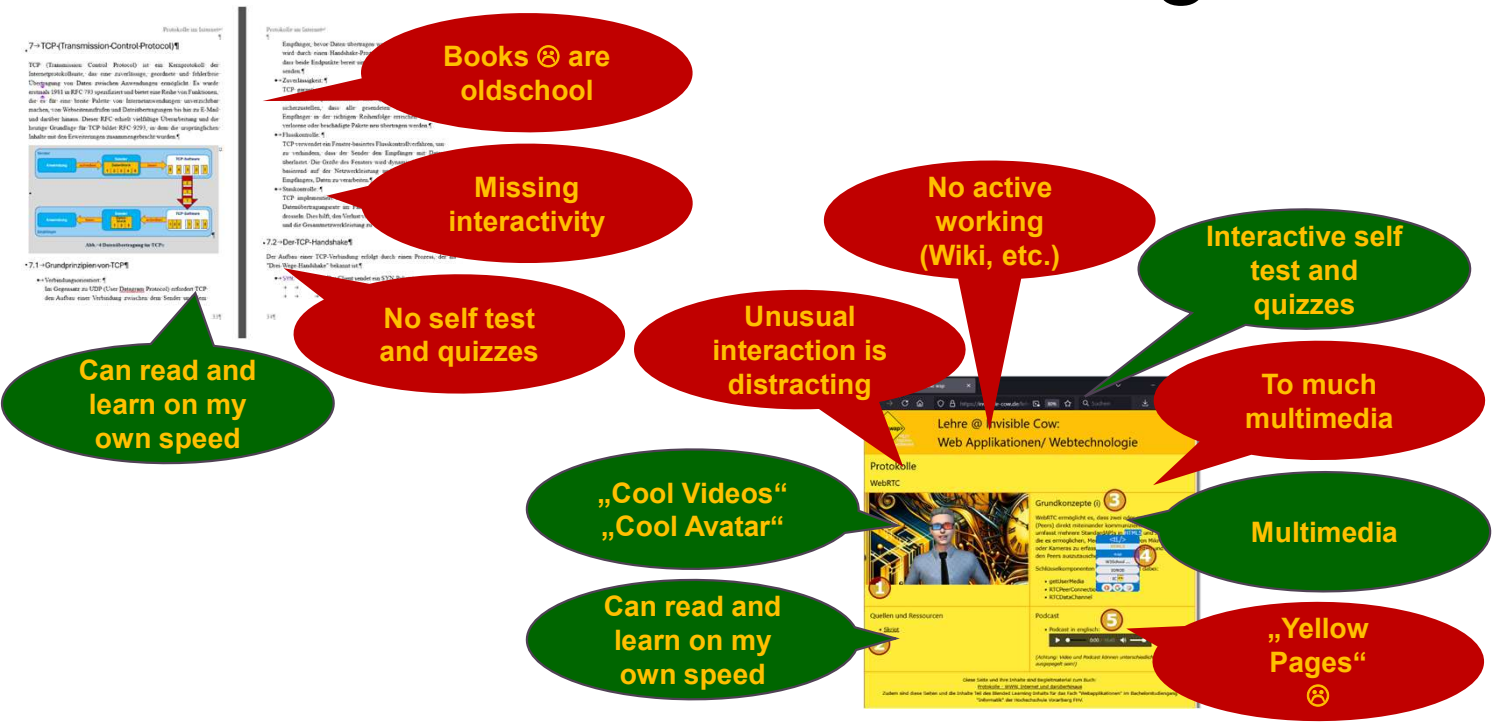

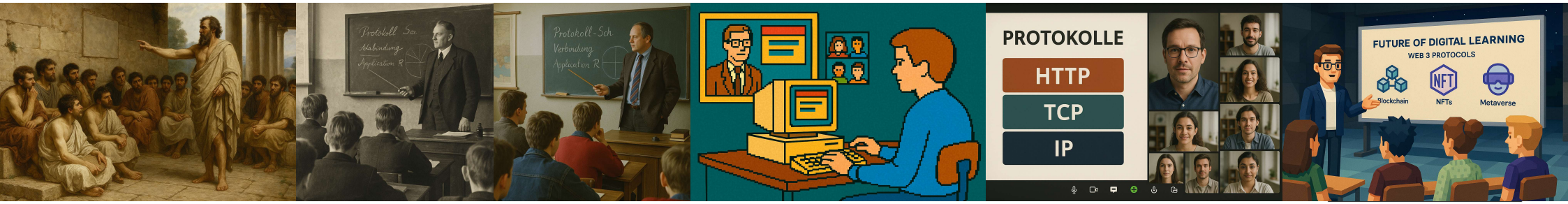

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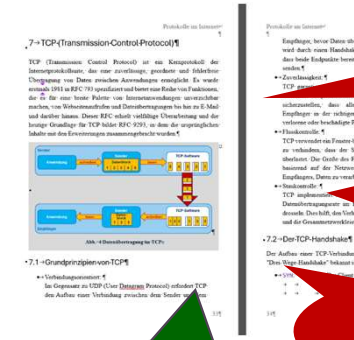


Books ☹ are oldschool

Missing interactivity

No self test and quizzes

Can read and learn on my own speed

No active working (Wiki, etc.)

Unusual interaction is distracting

Interactive self test and quizzes

To much multimedia

„Cool Videos“
„Cool Avatar“

Multimedia

Can read and learn on my own speed

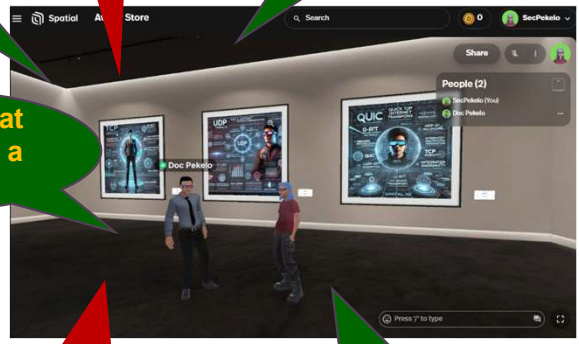
„Yellow Pages“ ☹

Need of Avatars

„Cool Avatar“

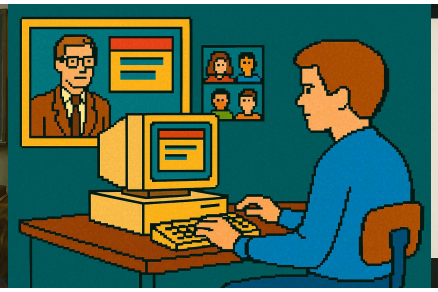
Individuality by Avatars

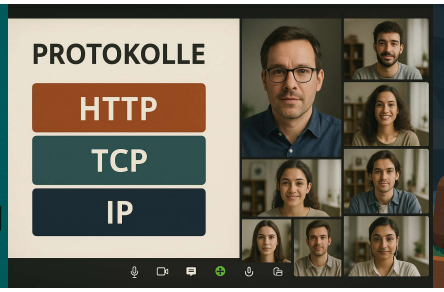
Amazing that this runs in a browser

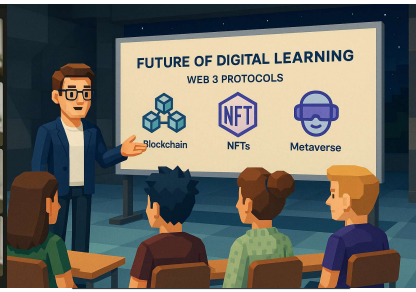


Just normal lessons in cyberspace

Collaboration







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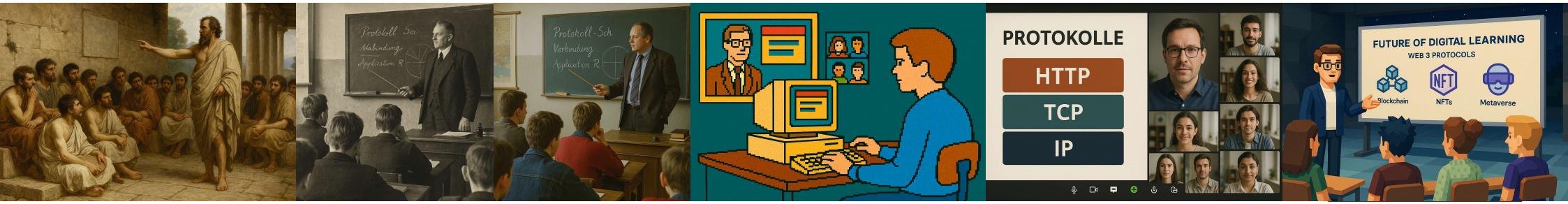
Some Conclusion, part 1:

→ The focus must be on: Media development (for learning purposes) = a continuous **technical** design process !

→ Technology alone is not enough:
→ Didactics, design, and the integration of **appropriate** interaction are crucial

→ **Immersive formats offer new opportunities**,
but still have to be critically reflected upon



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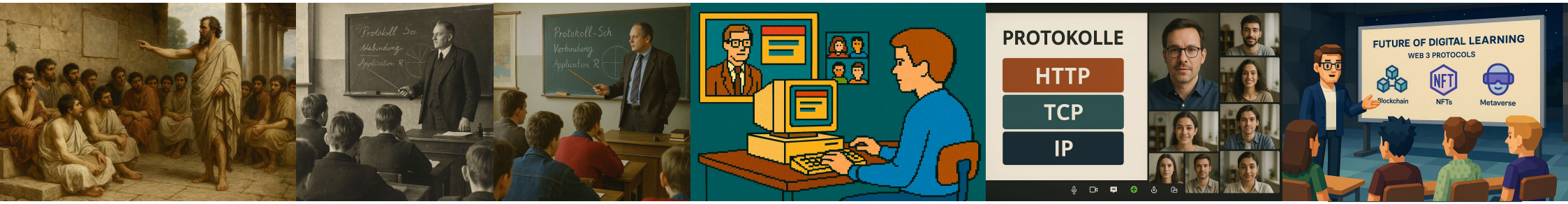
Some Conclusion, part 2:

→ 2 main questions are still open for the next steps:

→ Question 1:
Are the technical possibilities applicable to other (non-technical) disciplines?
(e.g. Philosophy, Medieval Studies, etc.)



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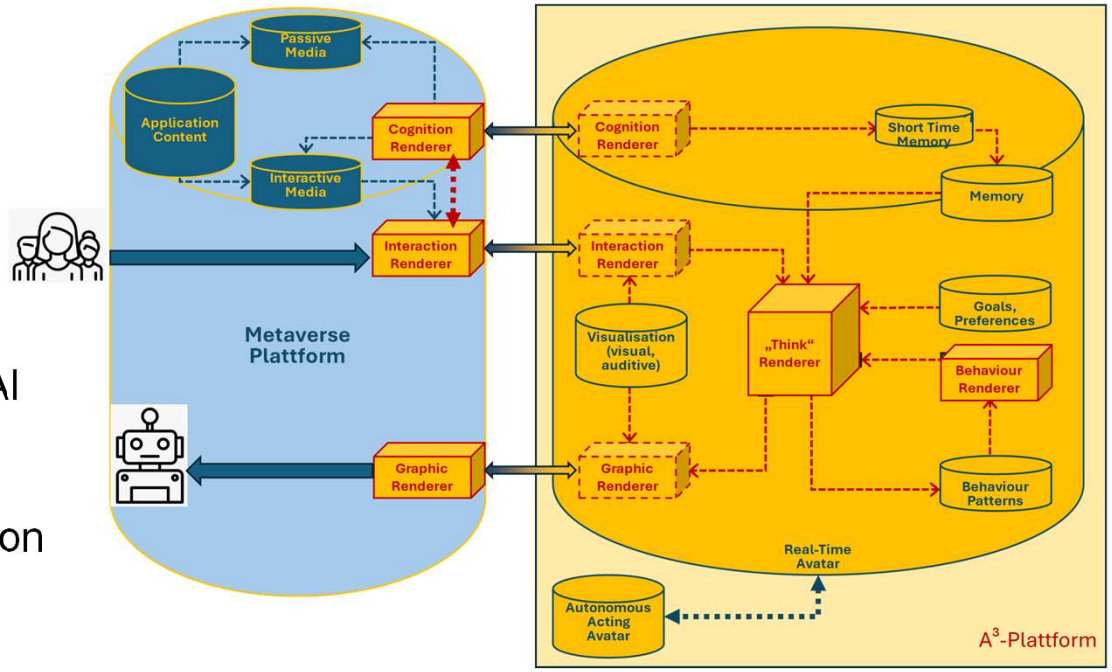
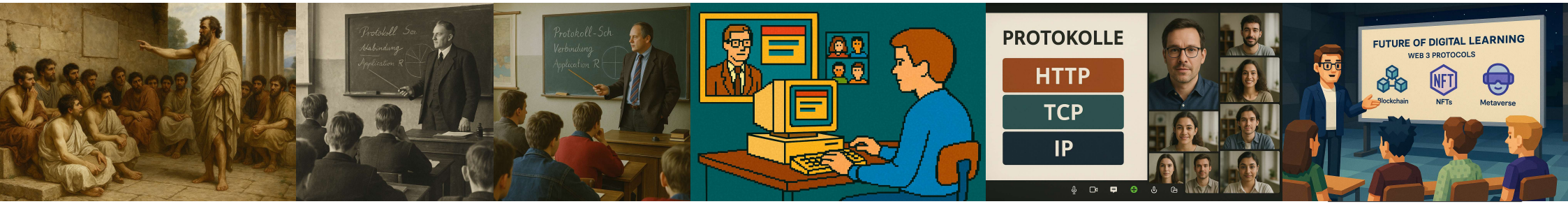
Some Conclusion, part 2:

→ 2 main questions are still open for the next steps:

- → Question 2: D2A-Learning
  - → Intelligent autonomous instructor avatar with AI (generative dialogue capabilities)
  - → Opportunities through personalization, constant availability, automated tutoring function
  - → Challenges: Didactics, ethics, transparency, quality assurance





We both thank you for your attention.

We are open for questions ☺

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