



The Effects of Audience Response Systems on Learning Outcomes in Health Professions Education: A Best Evidence Medical Education (BEME) Systematic Review

Cody Nelson, Lisa Hartling, Sandy
Campbell and Anna E. Oswald
University of Alberta
Edmonton, Canada



Our Team

- Cody Nelson, BSc
 - 2nd year medical student, summer studentship
- Lisa Hartling, MSc, PhD
 - Director, Alberta Research Centre for Health Evidence
 - Director, University of Alberta Evidence-based Practice Center
- Sandy Campbell, BA, MLS, AALIA (CP)
 - Public Services Librarian & library liaison to our Faculty
- Anna E. Oswald, MD, MMed, FRCPC
 - Consultant Rheumatologist
 - MSK preclinical course coordinator
 - Royal College of Physicians and Surgeons of Canada Clinician Educator



Audience Response Systems (ARS)

- Input device controlled by the learner, a receiver, and a display device connected to the receiver
- Affordable ARS marketed in 1999
- By 2003 began to have widespread use in post secondary institutions
- Health professions training programs have increasingly implemented ARS
- To date there have been no systematic reviews evaluating the effects of ARS in health professions training programs despite increasing number of schools considering implementing this technology



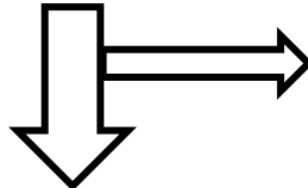
Review Protocol

- Key Inclusions:
 - Health professionals & trainees
 - Controlled comparative studies only
 - Learner reactions, attitude, knowledge, skills, behaviour outcomes
 - English language
- Key Exclusions
 - Teacher Eval Outcomes
 - Non teaching use of ARS (e.g. for quizzes, course evals ...)
 - Uncontrolled studies (e.g. uncontrolled before-after studies, prevalence assessments, needs assessments...)



Title and abstract screening:
2 independent reviewers

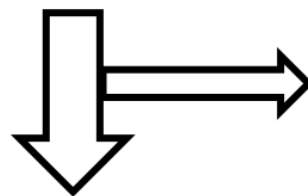
Potentially relevant studies
from electronic database
search (n=814), conference
proceedings (n=9), grey
literature (n=7), and reference
lists (n=177)
Total=1007



Excluded abstracts
(n=787)

Application of
inclusion form to
full texts:
2 independent
reviewers

Full text articles obtained from
electronic databases,
reference lists (n=220) and
contacting authors (n=6)



Excluded studies
(n=205)

Final number of included
articles (n = 21)



Methodology assessment:
2 independent reviewers

Data extraction



Data extraction:
1 reviewer + cross check
of 20% of articles by a 2nd
reviewer

Data synthesis



Results

- 2,637 participants involved in the included trials reviewed
- 21 included trials describe undergraduate (13), graduate (6), and professional (2) education
- Fields of medicine: nursing, pharmacy, veterinary medicine and dentistry
- All 21 trials assessed change in knowledge
- 6 assessed change in learner reactions
- 1 assessed change in self-confidence



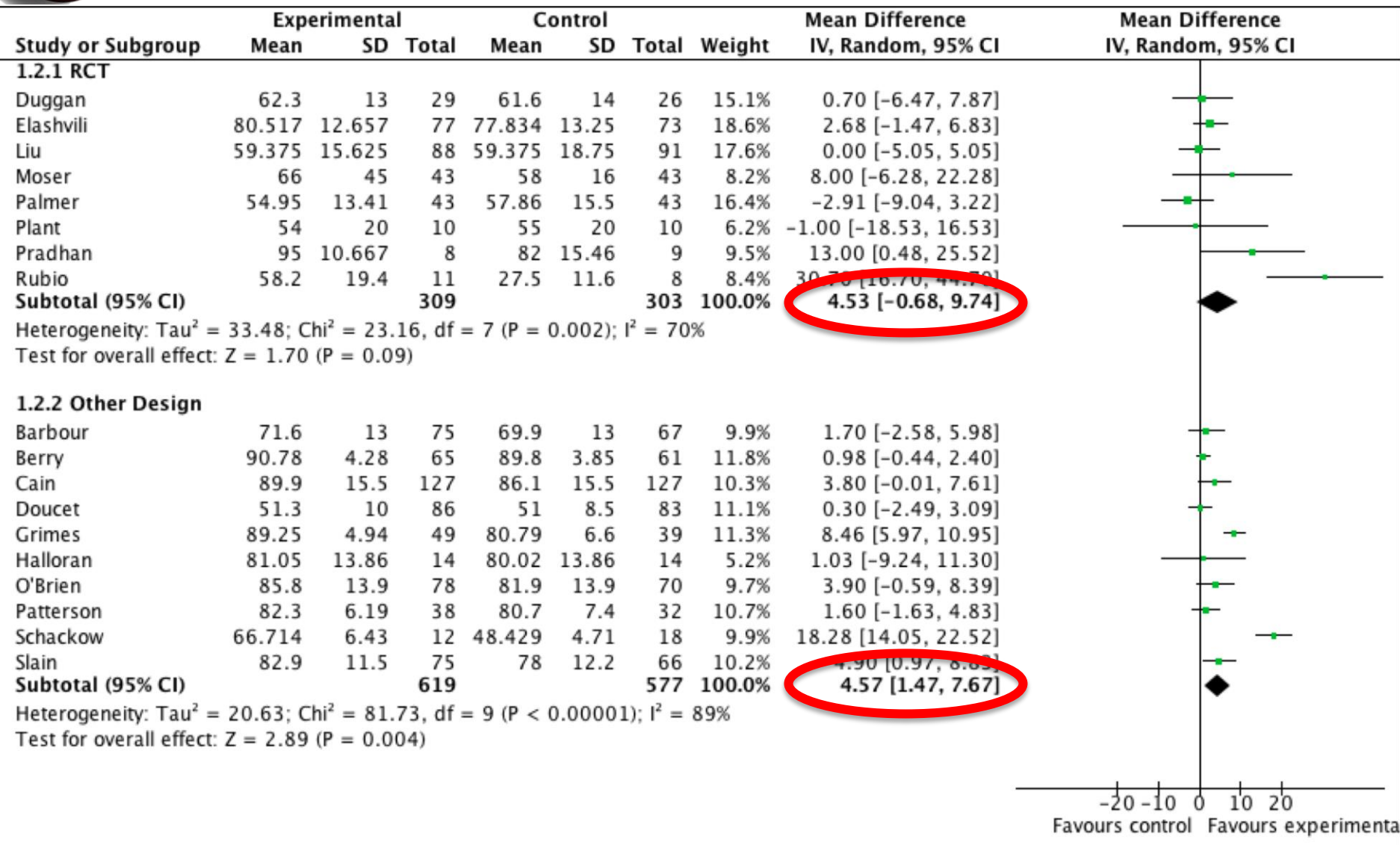
Quality Assessment

Type of study	Number	Common sources of bias
Randomized controlled trials	9	9/9: unclear blinding
		5/9: incomplete/unclear data presentation
Cohorts	10	10/10: incomplete comparison of cohorts
		3/10: incomplete participant follow up
Non-randomized controlled trials	2	2/2: inadequate blinding
		1/2: incomplete/unclear data presentation

- Only 1/21 had power calculation

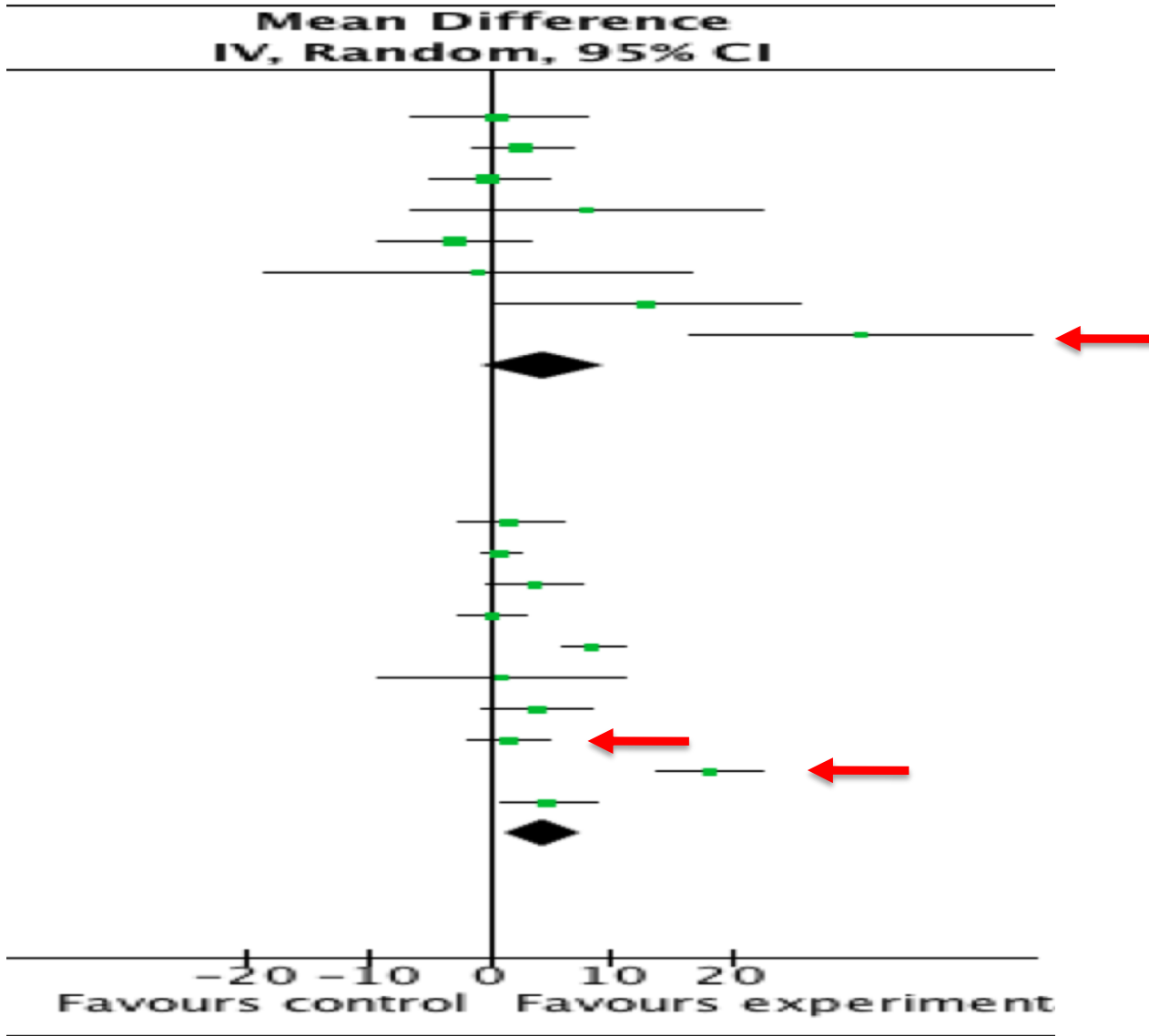


Immediate knowledge scores



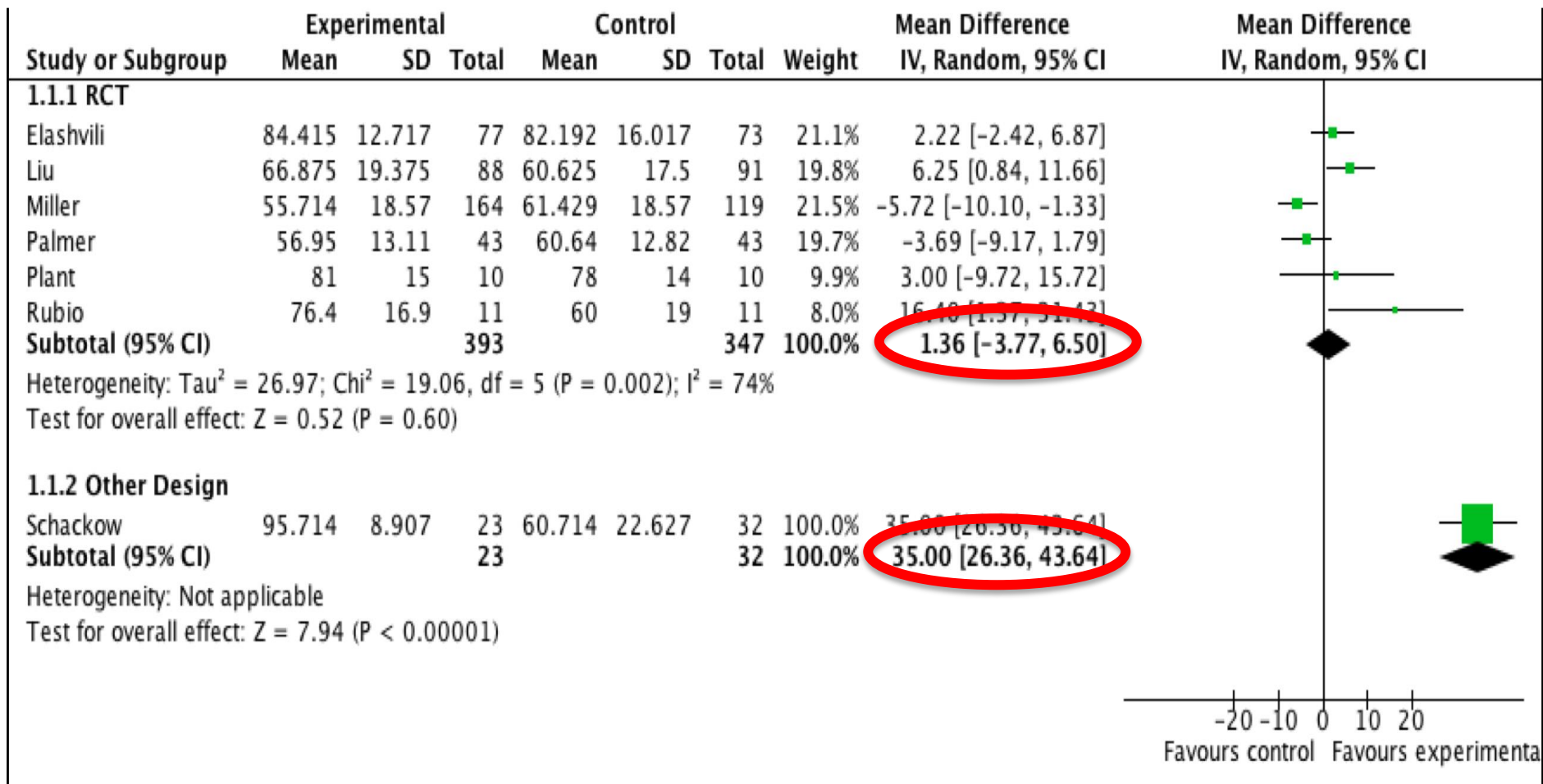


Closer up on immediate scores...





Long term knowledge scores





Results

- **Learner reaction** nearly all **positive**
- **RCTs** showed **no significant difference** in either immediate or long-term
- **Non-randomised studies** demonstrated a **significant difference** for both immediate and long term (latter analysis only 1 study)
- The **most significant** impact was observed when ARS was **compared to non-interactive teaching** methods



Conclusions

- We hypothesize that ARS provide **convenient** way to help teacher create interactive sessions
- In settings, such as **medical residencies**, where sleep deprivation & subsequent difficulties with attention are common, the ability of ARS to enhance learner interactivity may be even more beneficial, although further study is required
- This review highlights **the importance of having high quality studies** with balanced comparators available to those making curricular decisions about implementing new teaching strategies



Acknowledgements

- University of Alberta Faculty of Medicine and Dentistry Faculty Education Advisory Committee Summer Studentship
- Ben Vandermeer for his assistance in the statistical analysis



Conclusions

- ARS may improve short & long term **knowledge scores** and do result in more positive **learner reactions**
- Findings **more striking when** ARS compared to **non-interactive** sessions and when **non-randomized** study designs used
- We hypothesize that ARS provide **convenient** way to help teacher create interactive sessions
- In settings, such as **medical residencies**, where sleep deprivation & subsequent difficulties with attention are common, the ability of ARS to enhance learner interactivity may be even more beneficial, although further study is required
- This review highlights **the importance of having high quality studies** with balanced comparators available to those making curricular decisions about implementing new teaching strategies