

Το βιβλίο απευθύνεται σε όσους ενδιαφέρονται για την εκπαιδευτική διάσταση των εφαρμογών Εικονικής Πραγματικότητας και, συγκεκριμένα, της Πλήρως Εμβυθισμένης Εικονικής Πραγματικότητας. Αναλύει τεχνικά θέματα, εξετάζει τα βασικά χαρακτηριστικά της και παρουσιάζει το θεωρητικό πλαίσιο που στηρίζει την εισαγωγή της στην εκπαιδευτική πράξη. Σκοπός είναι οι αναγνώστες να εξοικειωθούν με αυτήν την τεχνολογία και να διαπιστώσουν την ελκυστικότητα και την αποτελεσματικότητά της. Κυρίως όμως, επιδιώκεται οι εκπαιδευτικοί να πειστούν για την αναγκαιότητα ένταξης αυτής της τεχνολογίας στην καθημερινή διδακτική τους πρακτική, αναβαθμίζοντας κατά αυτόν τον τρόπο την ποιότητα της παρεχόμενης εκπαίδευσης στους μαθητές. Οι δε ερευνητές μπορούν να βρουν χρήσιμο το βιβλίο, καθώς, μεταξύ άλλων, αναλύεται η υπάρχουσα βιβλιογραφία και προτείνεται συγκεκριμένο μοντέλο για την εξέταση των παραγόντων που την καθιστούν ισχυρό εκπαιδευτικό/μαθησιακό εργαλείο.



ΕΜΜΑΝΟΥΗΛ  
ΦΩΚΙΔΗΣ

Ο Εμμανουήλ Φωκίδης είναι Επίκουρος Καθηγητής στο Παιδαγωγικό Τμήμα Δημοτικής Εκπαίδευσης του Πανεπιστημίου Αιγαίου. Τα μαθήματά του εστιάζουν στις εκπαιδευτικές χρήσεις των αναδυόμενων τεχνολογιών, της Εικονικής και Επαυξημένης Πραγματικότητας, της ψηφιακής αφήγησης και στα τρισδιάστατα εκπαιδευτικά παιχνίδια. Από το 1994 συμμετέχει σε ερευνητικά έργα που αφορούν την εισαγωγή διαφόρων τεχνολογιών στην εκπαίδευση. Είναι ιδρυτικό στέλεχος της ερευνητικής πρωτοβουλίας Emerging Technologies in Education (ETiE). Το έργο του είναι δημοσιευμένο σε συνέδρια, κεφάλαια σε βιβλία και έγκριτα επιστημονικά περιοδικά.



ΠΗΝΕΛΟΠΗ  
ΑΤΣΙΚΠΑΣΗ

Η Πηνελόπη Ατσικπάση είναι εκπαιδευτικός και ερευνήτρια, κάτοχος δύο μεταπτυχιακών διπλωμάτων. Στα ενδιαφέροντά της περιλαμβάνονται οι εκπαιδευτικές χρήσεις της Εικονικής και Επαυξημένης Πραγματικότητας, η χρήση ταμπλετών και εφαρμογών πολυμέσων στην εκπαιδευτική διαδικασία, καθώς επίσης και η ανάπτυξη ερευνητικών εργαλείων για την αξιολόγηση και μελέτη των παραπάνω. Αποτελεί βασικό μέλος της ερευνητικής πρωτοβουλίας Emerging Technologies in Education (ETiE) από την αρχή της. Το έργο της είναι δημοσιευμένο σε συνέδρια, κεφάλαια σε βιβλία και έγκριτα επιστημονικά περιοδικά.

(ΠΛΗΡΩΣ ΕΜΒΥΘΙΣΜΕΝΗ)

ΕΙΚΟΝΙΚΗ

ΠΡΑΓΜΑΤΙΚΟΤΗΤΑ

Μάθηση και Εκπαίδευση



ΕΜΜΑΝΟΥΗΛ ΦΩΚΙΔΗΣ ΠΗΝΕΛΟΠΗ ΑΤΣΙΚΠΑΣΗ  
(ΠΛΗΡΩΣ ΕΜΒΥΘΙΣΜΕΝΗ)  
ΕΙΚΟΝΙΚΗ ΠΡΑΓΜΑΤΙΚΟΤΗΤΑ Μάθηση και Εκπαίδευση

ΕΜΜΑΝΟΥΗΛ  
ΦΩΚΙΔΗΣ

ΠΗΝΕΛΟΠΗ  
ΑΤΣΙΚΠΑΣΗ

(ΠΛΗΡΩΣ ΕΜΒΥΘΙΣΜΕΝΗ)

ΕΙΚΟΝΙΚΗ

ΠΡΑΓΜΑΤΙΚΟΤΗΤΑ

Μάθηση και Εκπαίδευση

(Πλήρως Εμβυθισμένη) Εικονική Πραγματικότητα,  
Μάθηση και Εκπαίδευση



Εμμανουήλ Φωκίδης

Πηνελόπη Ατσικπάση

(Πλήρως Εμβυθισμένη) Εικονική Πραγματικότητα,  
Μάθηση και Εκπαίδευση



© 2022, Εμμανουήλ Φωκίδης, Πηνελόπη Ατσικπάση

© 2022, Εκδόσεις “ΖΥΓΟΣ” • Μάρκου & ΣΙΑ Ε.Ε.

Αγγελάκη 39 – 546 21 Θεσσαλονίκη

Τηλ. - Fax: 2310 271055 - 2310 271043

ekdoseis@zygos.gr • www.zygos.gr

Επιμέλεια εξωφύλλου: Ζωή Σφαέλου

Ηλεκτρονική σελιδοποίηση: Εκδόσεις “ΖΥΓΟΣ”

ISBN: 978-618-5063-74-0

Η πνευματική ιδιοκτησία αποκτάται χωρίς καμία διατύπωση και χωρίς την ανάγκη ρήτρας απαγορευτικής των προσβολών της. Επισημαίνεται ότι κατά το Ν. 2387/1920 (όπως έχει τροποποιηθεί με το Ν. 2121/1993 και ισχύει σήμερα) και κατά τη Διεθνή Σύμβαση της Βέρνης (που έχει κυρωθεί με το Ν. 100/1975) απαγορεύεται η αναδημοσίευση και γενικά η αναπαραγωγή του παρόντος έργου, με οποιονδήποτε τρόπο, τμηματικά ή περιληπτικά, στο πρωτότυπο ή σε μετάφραση ή άλλη διασκευή, χωρίς γραπτή άδεια του εκδότη.

Learning is not compulsory... but neither is survival.  
~Dr. William Edwards Deming (1900-1993)



## ΠΕΡΙΕΧΟΜΕΝΑ

<b>Εισαγωγή-Τεχνολογία, μάθηση και εκπαίδευση .....</b>	<b>1</b>
<b>Κεφάλαιο 1. Εικονική Πραγματικότητα, ορισμοί και ιστορικό .....</b>	<b>13</b>
1.1. Ορισμοί για την Εικονική Πραγματικότητα .....	15
1.2. Ιστορική αναδρομή.....	19
<b>Κεφάλαιο 2. Head Mounted Displays .....</b>	<b>27</b>
2.1. Εννοιολογικό πλαίσιο για τα Head Mounted Displays .....	29
2.2. Αρχές και στοιχεία λειτουργίας των Head Mounted Displays.....	31
2.3. Παρουσίαση διαφόρων HMDs .....	48
<b>Κεφάλαιο 3. Τα βασικά χαρακτηριστικά της Εικονικής Πραγματικότητας .....</b>	<b>51</b>
3.1. Τα τρία Is της Εικονικής Πραγματικότητας.....	54
3.2. Η εμπύθιση .....	55
3.3. Η παρουσία.....	59
3.4. Η αλληλεπίδραση .....	62
3.5. Σχέση εμπύθισης και παρουσίας .....	64
3.6. Γενικά σχόλια .....	67
<b>Κεφάλαιο 4. Ταξινόμια συστημάτων Εικονικής Πραγματικότητας ....</b>	<b>69</b>
4.1. Υφιστάμενες ταξινομίες συστημάτων Εικονικής Πραγματικότητας .....	71
4.2. Προτεινόμενη ταξινόμια συστημάτων Εικονικής Πραγματικότητας ....	74
<b>Κεφάλαιο 5. Τομείς εφαρμογής της Εικονικής Πραγματικότητας .....</b>	<b>79</b>
5.1. Αθλητισμός και σωματική άσκηση.....	81
5.2. Απεικόνιση δεδομένων .....	82
5.3. Αυταρχισμός, βία, διλήμματα, φυλετικές και άλλες προκαταλήψεις.....	83
5.4. Βιομηχανικές εφαρμογές και σχεδιασμός προϊόντων .....	86
5.5. Δημοσιογραφία και ειδήσεις.....	86
5.6. Ιατρική.....	87
5.7. Κοινωνική συμπεριφορά, Proxemics.....	88
5.8. Μετασχηματισμός του σώματος.....	89
5.9. Πολιτιστική κληρονομιά.....	92
5.10. Συνεργασία, διαμοιρασμένα περιβάλλοντα .....	94
5.11. Ταξίδια και τουρισμός.....	95

5.12. Χωρική αναπαράσταση και πλοήγηση .....	96
5.13. Ψυχολογία και θεραπεία παθήσεων.....	98
<b>Κεφάλαιο 6. Εικονική Πραγματικότητα και μάθηση .....</b>	<b>103</b>
6.1. Η Εικονική Πραγματικότητα ως γνωστικό εργαλείο .....	105
6.2. Οι εκπαιδευτικές δυνατότητες της Εικονικής Πραγματικότητας .....	106
6.3. Παράγοντες της ΕΠ που επηρεάζουν τη μάθηση .....	108
<b>Κεφάλαιο 7. Πλήρως Εμβυθισμένη Εικονική Πραγματικότητα και μάθηση.....</b>	<b>115</b>
<b>Κεφάλαιο 8. Εκπαιδευτικές χρήσεις των 6DoF HMDs.....</b>	<b>123</b>
8.1. Είδη ανασκόπησης .....	125
8.1.1. Η συστηματική ανασκόπηση .....	125
8.1.2. Η ανασκόπηση πεδίου .....	127
8.1.3. Σύγκριση των δύο βασικότερων ειδών ανασκοπήσεων.....	128
8.2. Σχετικές επισκοπήσεις για την εκπαιδευτική χρήση των HMDs .....	129
8.3. Η παρούσα ανασκόπηση .....	133
8.4. Ανάλυση δεδομένων .....	137
8.4.1. Γενικά στοιχεία.....	138
8.4.2. Αξιόπιστα άρθρα.....	150
8.5. Διαπιστώσεις .....	157
8.6. Συμπεράσματα.....	170
<b>Κεφάλαιο 9. Η πλήρως εμβυθισμένη ψηφιακή μαθησιακή εμπειρία .....</b>	<b>171</b>
9.1. Σύνοψη των προηγούμενων κεφαλαίων .....	173
9.2. Ορίζοντας την Πλήρως Εμβυθισμένη Ψηφιακή Μαθησιακή Εμπειρία. ....	174
9.3. Παράγοντες που επηρεάζουν την ΠΕΨΜΕ .....	179
<b>Κεφάλαιο 10. Εικονική Πραγματικότητα και εποικοδομισμός.....</b>	<b>193</b>
10.1. Οι γενιές εκπαιδευτικής χρήσης των ηλεκτρονικών υπολογιστών... ..	195
10.2. Η τέταρτη γενιά εκπαιδευτικής χρήσης ηλεκτρονικών υπολογιστών. ....	197
10.3. Περισσότερα για τον εποικοδομισμό.....	200
10.4. Η σχέση εποικοδομισμού και τεχνολογίας .....	202
10.5. Η σχέση Εικονικής Πραγματικότητας και εποικοδομισμού .....	203



<b>Κεφάλαιο 11. Εικονική Πραγματικότητα και εξ αποστάσεως</b>	
<b>    εκπαίδευση .....</b>	<b>207</b>
11.1. Προβλήματα στην εξ αποστάσεως εκπαίδευση .....	209
11.2. Σύντομη ανασκόπηση πεδίου για τη σχέση ΕΠ και ΕΞΑΕ.....	210
11.3. Διαπιστώσεις.....	212
<b>Επίλογος.....</b>	<b>215</b>
<b>Βιβλιογραφία .....</b>	<b>223</b>
<b>Παράρτημα .....</b>	<b>277</b>

## ΚΑΤΑΛΟΓΟΣ ΠΙΝΑΚΩΝ

Πίνακας 1. Σύγκριση προδιαγραφών των 6DoF HMDs.....	49
Πίνακας 2. Σύγκριση προδιαγραφών των 3DoF HMDs.....	50
Πίνακας 3. Τα είδη εμπύθισης, παρουσίας και αλληλεπίδρασης .....	67
Πίνακας 4. Ενδεικτικά είδη ανασκοπήσεων .....	126
Πίνακας 5. Λέξεις-κλειδιά της αναζήτησης.....	135
Πίνακας 6. Κατηγορίες πληροφοριών για τη συλλογή δεδομένων.....	138
Πίνακας 7. Πίνακας άρθρων που περιλήφθηκαν στην ανασκόπηση .....	138
Πίνακας 8. Έτος δημοσίευσης άρθρων .....	141
Πίνακας 9. Είδος δημοσίευσης άρθρων .....	141
Πίνακας 10. Οι χώρες προέλευσης των δημοσιευμένων άρθρων .....	142
Πίνακας 11. Αναλυτική παρουσίαση του γνωστικού αντικειμένου .....	143
Πίνακας 12. Ομάδες στόχος.....	144
Πίνακας 13. Συνδυασμοί ομάδων στόχου .....	145
Πίνακας 14. Μικτός σχεδιασμός .....	145
Πίνακας 15. Ποιοτικός σχεδιασμός.....	145
Πίνακας 16. Ποσοτικός σχεδιασμός.....	146
Πίνακας 17. Μέγεθος δείγματος.....	146
Πίνακας 18. Διάρκεια των παρεμβάσεων.....	147
Πίνακας 19. Τα μέσα (HMDs) των παρεμβάσεων.....	148
Πίνακας 20. Κατηγορίες ερευνητικών ερωτημάτων.....	149
Πίνακας 21. Τα αποτελέσματα που αναφέρουν τα άρθρα .....	150
Πίνακας 22. Τα αξιόπιστα άρθρα.....	151
Πίνακας 23. Σύνοψη των αξιόπιστων άρθρων.....	152
Πίνακας 24. Ερευνητικά ερωτήματα αξιόπιστων άρθρων .....	153
Πίνακας 25. Τα αποτελέσματα των αξιόπιστων άρθρων .....	153

Πίνακας 26. Έννοιες που εξέταζαν τα ερωτηματολόγια.....	180
Πίνακας 27. Συχνότητα εμφάνισης παραγόντων στα ερωτηματολόγια.....	181
Πίνακας 28. Παράγοντες ανά έννοια (α).....	182
Πίνακας 29. Παράγοντες ανά έννοια (β).....	183
Πίνακας 30. Παράγοντες ανά έννοια (γ).....	184
Πίνακας 31. Παράγοντες ανά έννοια (δ).....	184
Πίνακας 32. Παράγοντες ανά έννοια (ε).....	184
Πίνακας 33. Παράγοντες ανά έννοια (στ).....	185
Πίνακας 34. Ενοποίηση παραγόντων.....	189

## ΚΑΤΑΛΟΓΟΣ ΕΙΚΟΝΩΝ

Εικόνα 1. Η μάχη του Borodino.....	19
Εικόνα 2. Το στερεοσκόπιο.....	20
Εικόνα 3. Link trainer.....	21
Εικόνα 4. Sensorama.....	21
Εικόνα 5. Telesphere Mask.....	22
Εικόνα 6. Headsight.....	22
Εικόνα 7. Το σπαθί του Δαμοκλή.....	23
Εικόνα 8. Jaron Lanier.....	23
Εικόνα 9. Προσομοίωση οχήματος.....	24
Εικόνα 10. CAVE.....	24
Εικόνα 11. SimEye SR100A.....	25
Εικόνα 12. Oculus Rift DK1.....	26
Εικόνα 13. HTC Vive.....	26
Εικόνα 14. Oculus Rift DK1.....	26
Εικόνα 15. Oculus Quest.....	26
Εικόνα 16. Vision 8K X.....	26
Εικόνα 17. Διάφορα HMDs.....	30
Εικόνα 18. Τα βασικά μέρη ενός HMD.....	31
Εικόνα 19. Barrel distortion.....	35
Εικόνα 20. Χειριστήρια 6DoF.....	46
Εικόνα 21. Οπτικοποίηση συχνότητας εμφάνισης των παραγόντων.....	186

## ΚΑΤΑΛΟΓΟΣ ΣΧΗΜΑΤΩΝ

Σχήμα 1. Η αντίληψη πραγματικότητας και Εικονικής Πραγματικότητας.....	16
Σχήμα 2. Το συνεχές πραγματικότητας-εικονικότητας.....	19
Σχήμα 3. Δημιουργία εικονικής οθόνης στα HMDs .....	33
Σχήμα 4. Κατασκευή φακού Fresnel .....	34
Σχήμα 5. Το οπτικό πεδίο του ανθρώπου .....	36
Σχήμα 6. Το οπτικό πεδίο του περιστεριού και της κουκουβάγιας.....	37
Σχήμα 7. Θέση και κατεύθυνση στα HMDs.....	42
Σχήμα 8. Τα 3Is της Εικονικής Πραγματικότητας .....	54
Σχήμα 9. Το συνεχές αλληλεπίδρασης και εμπύθισης .....	66
Σχήμα 10. Ταξινόμια των συστημάτων Εικονικής Πραγματικότητας .....	72
Σχήμα 11. Μία άλλη ταξινόμια των συστημάτων ΕΠ .....	73
Σχήμα 12. Προτεινόμενη ταξινόμια συστημάτων ΕΠ .....	77
Σχήμα 13. Το συνεχές της εμπύθισης των συστημάτων ΕΠ .....	78
Σχήμα 14. Διάγραμμα PRISMA για την ανασκόπηση των 6DoF HMDs .....	137
Σχήμα 15. Η πλήρως εμπυθισμένη ψηφιακή μαθησιακή εμπειρία .....	179
Σχήμα 16. Οι σχέσεις μεταξύ εννοιών και των παραγόντων τους.....	187
Σχήμα 17. Το προτεινόμενο μοντέλο παραγόντων της ΠΕΨΜΕ.....	192
Σχήμα 18. Εμπειρίες "πρώτου" και "τρίτου" προσώπου .....	198
Σχήμα 19. Διάγραμμα PRISMA για τη σχέση ΕΠ και ΕΞΑΕ .....	211

## ΚΑΤΑΛΟΓΟΣ ΓΡΑΦΗΜΑΤΩΝ

Γράφημα 1.Οι χώρες προέλευσης των δημοσιευμένων άρθρων.....	142
Γράφημα 2. Οι ευρύτερες θεματικές περιοχές των άρθρων .....	144
Γράφημα 3. Τα μεγέθη των δειγμάτων στα άρθρα .....	147

## ΑΚΡΩΝΥΜΙΑ

3Is. Interaction, Immersion, Imagination

ΕΞΑΕ. Εξ Αποστάσεως Εκπαίδευση

ΕΠ. Εικονική Πραγματικότητα

ΠΕΕΠ. Πλήρως Εμπυθισμένη Εικονική Πραγματικότητα

ΠΕΨΜΕ. Πλήρως Εμπυθισμένη Ψηφιακή Μαθησιακή Εμπειρία

ΨΜΕ. Ψηφιακή Μαθησιακή Εμπειρία

ΤΠΕ. Τεχνολογίες της Πληροφορίας και της Επικοινωνίας

## **Βιβλιογραφία**





## Ελληνόγλωσση

- Μικρόπουλος, Α. (2016). *Πανεπιστημιακές σημειώσεις*. Πανεπιστήμιο Ιωαννίνων.
- Νάτσης, Α., & Ζαχαρής, Γ. (2008). Ιδιότητες εκπαιδευτικών εικονικών περιβαλλόντων 2: Συστήματα εμπύθισης. *Πρακτικά βου Πανελληνίου Συνέδριου με Διεθνή Συμμετοχή "Οι ΤΠΕ στην Εκπαίδευση"*, 145-152.
- Φωκίδης, Ε., & Τσολακίδης, Κ. (2011). *Εικονική πραγματικότητα στην εκπαίδευση: Θεωρία και πράξη*. Διάδραση.

## Ξενόγλωσση

- Abulrub, A.-H. G., Attridge, A. N., & Williams, M. (2011). Virtual reality in engineering education: the future of creative learning. *Proceedings of the Global Engineering Education Conference (EDUCON)*, 751-757. IEEE. <https://doi.org/10.1109/EDUCON.2011.5773223>
- Acar, C., & Shkel, A. (2008). *MEMS vibratory gyroscopes: structural approaches to improve robustness*. Springer Science & Business Media. <https://doi.org/10.1007/978-0-387-09536-3>
- Adams, E. (2004). *Postmodernism and the three types of immersion*. [http://www.designersnotebook.com/Columns/063\\_Postmodernism/063\\_postmodernism.htm](http://www.designersnotebook.com/Columns/063_Postmodernism/063_postmodernism.htm)
- Adelman, J. S., & Estes, Z. (2013). Emotion and memory: A recognition advantage for positive and negative words independent of arousal. *Cognition*, 129(3), 530-535. <https://doi.org/10.1016/j.cognition.2013.08.014>
- Agiledrop (2020). *Customer experience, user experience & digital experience: Basics & useful terms*. <https://www.agiledrop.com/blog/customer-experience-user-experience-digital-experience-basics-useful-terms>
- Ahn, S. J., Le, A. M. T., & Bailenson, J. (2013). The effect of embodied experiences on self-other merging, attitude, and helping behavior. *Media Psychology*, 16, 7-38. <https://doi.org/10.1080/15213269.2012.755877>
- Ahn, S. J. G., Bailenson, J. N., & Park, D. (2014). Short- and long-term effects of embodied experiences in immersive virtual environments on environmental locus of control and behavior. *Computers in Human Behavior*, 39, 235-245. <https://doi.org/10.1016/j.chb.2014.07.025>
- Al-Kadi, A. S., Donnon, T., Paolucci, E. O., Mitchell, P., Debru, E., & Church, N. (2012). The effect of simulation in improving students' performance in laparoscopic surgery: a meta-analysis. *Surgical Endoscopy*, 26, 3215-3224. <https://doi.org/10.1007/s00464-012-2327-z>

- Alaraj, A., Lemole, M. G., Finkle, J. H., Yudkowsky, R., Wallace, A., Luciano, C., Banerjee, P. P., Rizzi, S. H., & Charbel, F. T. (2011). Virtual reality training in neurosurgery: review of current status and future applications. *Surgical Neurology International*, 2, 52. <https://doi.org/10.4103/2152-7806.80117>
- Alawadhi, S., AlHabib, N., Murad, D., AlDeei, F., AlHouti, M., Beyrouthy, T., & Al-Kork, S. (2017). Virtual reality application for interactive and informative learning. *Proceedings of the 2nd International Conference on Bio-engineering for Smart Technologies (BioSMART) 2017*, 1-4. IEEE. <https://doi.org/10.1109/BIOSMART.2017.8095336>
- Alhalabi, W. S. (2016). Virtual reality systems enhance students' achievements in engineering education. *Behaviour & Information Technology*, 35(11), 919-925. <https://doi.org/10.1080/0144929X.2016.1212931>
- Alqahtani, A. S., Daghestani, L. F., & Ibrahim, L. F. (2017). Environments and system types of virtual reality technology in STEM: A survey. *International Journal of Advanced Computer Science and Applications (IJACSA)*, 8(6), 77-89. <https://doi.org/10.14569/IJACSA.2017.080610>
- Almoussa, O., Prates, J., Yeslam, N., Mac Gregor, D., Zhang, J., Phan, V., Nielsen, M., Smith, R., & Qayumi, K. (2019). Virtual reality simulation technology for cardiopulmonary resuscitation training: An innovative hybrid system with haptic feedback. *Simulation and Gaming*, 50(1), 6-22. <https://doi.org/10.1177/1046878118820905>
- Anderson, P. L., Price, M., Edwards, S. M., Obasaju, M. A., Schmertz, S. K., Zimand, E., & Calamaras, M. R. (2013). Virtual reality exposure therapy for social anxiety disorder: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*, 81(5), 751-760. <https://doi.org/10.1037/a0033559>
- Anderson, S., Allen, P., Peckham, S., & Goodwin, N. (2008). Asking the right questions: scoping studies in the commissioning of research on the organisation and delivery of health services. *Health Research Policy and Systems*, 6(1), 7. <https://doi.org/10.1186/1478-4505-6-7>
- Anderson-Hanley, C., Arciero, P. J., Brickman, A. M., Nimon, J. P., Okuma, N., Westen, S. C., Merz, M. E., Pence, B. D., Woods, J. A., Kramer, A. F., & Zimmerman, E. A. (2012). Exergaming and older adult cognition: a cluster randomized clinical trial. *American Journal of Preventive Medicine*, 42(2), 109-119. <https://doi.org/10.1016/j.amepre.2011.10.016>
- Anderson-Hanley, C., Snyder, A. L., Nimon, J. P., & Arciero, P. J. (2011). Social facilitation in virtual reality-enhanced exercise: competitiveness moderates exercise effort of older adults. *Clinical Interventions in Aging*, 6, 275-280. <https://doi.org/10.2147/CIA.S25337>

- Antonacci, D., & Modaress, N. (2005). Second life: The educational possibilities of a massively multiplayer virtual world (MMVW). *Proceedings of the EDU-CAUSE Western Regional Conference-Winds of Change: Charting the Course for Technology in Challenging Times* (vol. 28).
- Aprile, I., Ferrarin, M., Padua, L., Di Sipio, E., Simbolotti, C., Petroni, S., Tredici, C., & Dickmann, A. (2014). Walking strategies in subjects with congenital or early onset strabismus. *Frontiers in Human Neuroscience*, *8*, 484. <https://doi.org/10.3389/fnhum.2014.00484>
- AR VR Journey (2017). *Binaural audio: How 3D audio hacks your brain*. <https://arvrjourney.com/binaural-audio-how-3d-audio-hacks-your-brain-a3de0ceb4196>
- Araullo, J., & Potter, L. E. (2015). The emerging technology consumer: Designing NUI interaction for learning and retention. *Proceedings of the OzCHI 2015: Being Human*, 78-82. <https://doi.org/10.1145/2838739.2838830>
- Argelaguet Sanz, F., Multon, F., & Lécuyer, A. (2015). A methodology for introducing competitive anxiety and pressure in VR sports training. *Frontiers in Robotics and AI*, *2*, 10. <https://doi.org/10.3389/frobt.2015.00010>
- Arksey, H., & O'Malley, L. (2005). Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*, *8*(1), 19-32. <https://doi.org/10.1080/1364557032000119616>
- Aromataris, E., & Pearson, A. (2014). The systematic review: an overview. *AJN the American Journal of Nursing*, *114*(3), 53-8. <https://doi.org/10.1097/01.NAJ.0000444496.24228.2c>
- Arora, A., Lau, L. Y., Awad, Z., Darzi, A., Singh, A., & Tolley, N. (2014). Virtual reality simulation training in Otolaryngology. *International Journal of Surgery*, *12*(2), 87-94. <https://doi.org/10.1016/j.ijso.2013.11.007>
- Artino, A. R. (2012). Emotions in online learning environments: Introduction to the special issue. *The Internet and Higher Education*, *15*(3), 137-140. <https://doi.org/10.1016/j.iheduc.2012.04.001>
- Atmatzidou, S., & Demetriadis, S. (2016). Advancing students' computational thinking skills through educational robotics: A study on age and gender relevant differences. *Robotics and Autonomous Systems*, *75*, 661-670. <https://doi.org/10.1016/j.robot.2015.10.008>
- Aukstakalnis, S., & Blatner, D. (1992). *Silicon Mirage: The art and science of Virtual Reality*. Peach Pit Press.
- Bailenson, J. N., Blascovich, J., & Beall, A. C. (2001). Equilibrium theory revisited: mutual gaze and personal space in virtual environments. *Presence: Teleoperators & Virtual Environments*, *10*(6), 583-598. <https://doi.org/10.1162/105474601753272844>

- Bailenson, J. N., Blascovich, J., Beall, A. C., & Loomis, J. (2003). Interpersonal distance in immersive virtual environments. *Personality and Social Psychology Bulletin*, 29(7), 819-833. <https://doi.org/10.1177/0146167203029007002>
- Bailenson, J. N., Yee, N., Blascovich, J., Beall, A. C., Lundblad, N., & Jin, M. (2008). The use of immersive virtual reality in the learning sciences: digital transformations of teachers, students, and social context. *The Journal of the Learning Sciences*, 17(1), 102-141. <https://doi.org/10.1080/10508400701793141>
- Bailenson, J. N., Yee, N., Brave, S., Merget, D., & Koslow, D. (2007). Virtual interpersonal touch: expressing and recognizing emotions through haptic devices. *Human-Computer Interaction*, 22(3), 325-353.
- Bainbridge, W. S. (2004). *Berkshire encyclopedia of human-computer interaction* (vol. 1). Berkshire Publishing Group LLC.
- Balakrishnan, B., & Sundar, S. (2011). Where am I? How can I get there? Impact of navigability and narrative transportation on spatial presence. *Human-Computer Interaction*, 26(3), 161-204.
- Banakou, D., Groten, R., & Slater, M. (2013). Illusory ownership of a virtual child body causes overestimation of object sizes and implicit attitude changes. *Proceedings of the National Academy of Sciences*, 110(31), 12846-12851. <https://doi.org/10.1073/pnas.1306779110>
- Barfield, W., & Hendrix, C. (1995). The effect of update rate on the sense of presence within virtual environments. *Virtual Reality*, 1(1), 3-15. <https://doi.org/10.1007/BF02009709>
- Barker, B., Valentine, D., Grandgenett, N., Keshwani, J., & Burnett, A. (2018). Using Virtual Reality and Telepresence Robotics in Making. *Proceedings of the E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2018*, 564-568. Association for the Advancement of Computing in Education (AACE).
- Barlow, J., Dyson, E., Leary, T., Bricken, W., Robinett, W., & Lanier, J. (1990). Hip, hype and hope-the three faces of virtual worlds (panel session). *Proceedings of the ACM SIGGRAPH 90 Panel*, 1001-1029. ACM. <https://doi.org/10.1145/328750.328798>
- Basdogan, C., Ho, C.-H., Srinivasan, M. A., & Slater, M. (2000). An experimental study on the role of touch in shared virtual environments. *ACM Transactions on Computer-Human Interaction*, 7(4), 443-460. <https://doi.org/10.1145/365058.365082>
- Bednar, A. K., Cunningham, D., Duffy, T. M., & Perry, J. D. (1992). Theory into practice: How do we link. *Constructivism and the Technology of Instruction: A Conversation*, 8(1), 17-34.

- Bellotti, F., Berta, R., & De Gloria, A. (2010). Designing effective serious games: opportunities and challenges for research. *International Journal of Emerging Technologies in Learning*, 5(2010). <https://doi.org/10.3991/ijet.v5s3.1500>
- Bem, D. J. (1972). Self-perception theory. *Advances in Experimental Social Psychology*, 6, 1-62. [https://doi.org/10.1016/S0065-2601\(08\)60024-6](https://doi.org/10.1016/S0065-2601(08)60024-6)
- Bertella, L., Marchi, S., & Riva, G. (2001). Virtual environment for topographical orientation (VETO): clinical rationale and technical characteristics. *Presence: Teleoperators & Virtual Environments*, 10(4), 440-449. <https://doi.org/10.1162/1054746011470280>
- Bertrand, J., Bhargava, A., Madathil, K. C., Gramopadhye, A., & Babu, S. V. (2017). The effects of presentation method and simulation fidelity on psychomotor education in a bimanual metrology training simulation. *Proceedings of the 2017 IEEE Symposium on 3D User Interfaces*, 3DUI 2017, 59-68. <https://doi.org/10.1109/3DUI.2017.7893318>
- Beti, R. A., Al-Khatib, F., & Cook, D. M. (2018). The efficacy of using virtual reality for job interviews and its effects on mitigating discrimination. *Proceedings of the International Conference on Computing and Information Technology*, 43-52. Springer. [https://doi.org/10.1007/978-3-319-93692-5\\_5](https://doi.org/10.1007/978-3-319-93692-5_5)
- Bibic, L., Druskis, J., Walpole, S., Angulo, J., & Stokes, L. (2019). Bug off pain: An educational virtual reality game on spider venoms and chronic pain for public engagement. *Journal of Chemical Education*, 96, 1486-1490. <https://doi.org/10.1021/acs.jchemed.8b00905>
- Bideau, B., Kulpa, R., Vignais, N., Brault, S., Multon, F., & Craig, C. (2010). Using virtual reality to analyze sports performance. *IEEE Computer Graphics and Applications*, 30(2), 14-21. <https://doi.org/10.1109/MCG.2009.134>
- Biederman, I. (1987). Recognition-by-components: A theory of human image understanding. *Psychological Review*, 94(2), 115-147. <https://doi.org/10.1037/0033-295X.94.2.115>
- Bindman, S. W., Castaneda, L. M., Scanlon, M., & Cechony, A. (2018). Am I a bunny? The impact of high and low immersion platforms and viewers' perceptions of role on presence, narrative engagement, and empathy during an animated 360° video. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, 1-11. <https://doi.org/10.1145/3173574.3174031>
- Biondi, R., Pagnotta, P., Trentini, G., Cirotti, T., & Parretti, C. (2015). The wow effect. *Proceedings of the EGU General Assembly 2015*.
- Bioulac, S., Micoulaud-Franchi, J.-A., Maire, J., Bouvard, M. P., Rizzo, A. A., Sagaspe, P., & Philip, P. (2018). Virtual Remediation versus methylphenidate to improve distractibility in children with ADHD: A controlled randomized clinical trial study. *Journal of Attention Disorders*, 24(2), 326-335. <https://doi.org/10.1177/1087054718759751>



- Bjork, S., & Holopainen, J. (2004). *Patterns in game design (Game development series)*. Charles River Media Inc.
- Blackler, A., Desai, S., McEwan, M., Popovic, V., & Diefenbach, S. (2019). Perspectives on the nature of intuitive interaction. In A. Blackler (Ed.), *Intuitive interaction: Research and application* (pp. 19-39). CRC Press.  
<https://doi.org/10.1201/b22191-2>
- Blanchard, C., Burgess, S., Harvill, Y., Lanier, J., Lasko, A., & Oberman, M. (1990). Reality built for two: a virtual reality tool. *ACM SIGGRAPH Computer Graphics*, 24, 35-36. <https://doi.org/10.1145/91394.91409>
- Blanke, O. (2012). Multisensory brain mechanisms of bodily self-consciousness. *Nature Reviews Neuroscience*, 13(8), 556-571.  
<https://doi.org/10.1038/nrn3292>
- Blanke, O., Slater, M., & Serino, A. (2015). Behavioral, neural, and computational principles of bodily self-consciousness. *Neuron*, 88(1), 145-166.  
<https://doi.org/10.1016/j.neuron.2015.09.029>
- Blascovich, J., Loomis, J., Beall, A., Swinth, K., Hoyt, C., & Bailenson, J.N. (2002). Immersive virtual environment technology as a methodological tool for social psychology. *Psychological Inquiry*, 13(2), 103-124.  
[https://doi.org/10.1207/S15327965PLI1302\\_01](https://doi.org/10.1207/S15327965PLI1302_01)
- Blom, K. J., Arroyo-Palacios, J., & Slater, M. (2014). The effects of rotating the self out of the body in the full virtual body ownership illusion. *Perception*, 43(4), 275-294. <https://doi.org/10.1068/p7618>
- Blurbusters (2019). *VR guide 2019: Compare popular virtual reality headsets*. <https://blurbusters.com/best-vr-guide-2019-compare-popular-virtual-reality-headsets/>
- Boe, A. & Prasolova-Forland, E. (2015). Teaching and learning aquaculture in virtual reality with Oculus Rift. *Proceedings of the E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2015*, 1426-1435. Association for the Advancement of Computing in Education (AACE).
- Boethel, M., & Dimock, K. V. (1999). *Constructing knowledge with technology: A review of the literature*. Southwest Educational Development Laboratory.
- Bonde, M. T., Makransky, G., Wandall, J., Larsen, M. V., Morsing, M., Jarmer, H., Sommer, M. O. A. (2014). Improving biotech education through gamified laboratory simulations. *Nature Biotechnology*, 32(7), 694-697.  
<https://doi.org/10.1038/nbt.2955>
- Borland, D., Peck, T., & Slater, M. (2013). An evaluation of self-avatar eye movement for virtual embodiment. *IEEE Transactions on Visualization and Computer Graphics*, 19(4), 591-596. <https://doi.org/10.1109/TVCG.2013.24>

- Botvinick, M., & Cohen, J. (1998). Rubber hands "feel" touch that eyes see. *Nature*, 391(6669), 756-756. <https://doi.org/10.1038/35784>
- Bourdin, P., Sanahuja, J. M. T., Moya, C. C., Haggard, P., & Slater, M. (2013). Persuading people in a remote destination to sing by beaming there. *Proceedings of the 19th ACM Symposium on Virtual Reality Software and Technology*, 123-132. ACM. <https://doi.org/10.1145/2503713.2503724>
- Brooks, J. G., & Brooks, M. G. (1999). *In search of understanding: The case for constructivist classrooms*. AscD.
- Brown, E., Hobbs, M., & Gordon, M. (2008). A virtual world environment for group work. *International Journal of Web-Based Learning and Teaching Technologies (IJWLTT)*, 3(1), 1-12. <https://doi.org/10.4018/jwlтт.2008010101>
- Brown, J. (2019). *How gender questioning and transgender gamers found a safe space in VR*. [www.digitaltrends.com](http://www.digitaltrends.com)
- Bowman, D. A., & McMahan, R. P. (2007). Virtual reality: how much immersion is enough? *Computer*, 40(7), 36-43. <https://doi.org/10.1109/MC.2007.257>
- Bowman, D. A., McMahan, R. P., & Ragan, E. D. (2012). Questioning naturalism in 3D user interfaces. *Communications of the ACM*, 55(9), 78-88. <https://doi.org/10.1145/2330667.2330687>
- Bradley, R., & Newbutt, N. (2018). Autism and virtual reality head-mounted displays: A state of the art systematic review. *Journal of Enabling Technologies*, 12(3), 101-113. <https://doi.org/10.1108/JET-01-2018-0004>
- Brand, S., Reimer, T., & Opwis, K. (2007). How do we learn in a negative mood? Effects of a negative mood on transfer and learning. *Learning and Instruction*, 17(1), 1-16. <https://doi.org/10.1016/j.learninstruc.2006.11.002>
- Brault, S., Bideau, B., Kulpa, R., & Craig, C. (2009). Detecting deceptive movement in 1 vs. 1 based on global body displacement of a rugby player. *International Journal of Virtual Reality*, 8(4) 31-36. <https://doi.org/10.20870/IJVR.2009.8.4.2746>
- Bric, J. D., Lumbard, D. C., Frelich, M. J., & Gould, J. C. (2016). Current state of virtual reality simulation in robotic surgery training: a review. *Surgical Endoscopy*, 30, 2169–2178. <https://doi.org/10.1007/s00464-015-4517-y>
- Brien, S., Lorenzetti, D., Lewis, S., Kennedy, J., & Ghali, W. (2010). Overview of a formal scoping review on health system report cards. *Implementation Science*, 5(1), 1-12. <https://doi.org/10.1186/1748-5908-5-2>
- Briscoe, F. M. (2012). Anarchist, neoliberal & democratic decision-making: Deepening the joy in learning and teaching. *Educational Studies*, 48(1), 76-102. <https://doi.org/10.1080/00131946.2011.637257>
- Brotos-Mas, J. R., O'Mara, S., & Sanchez-Vives, M. V. (2006). Neural processing of spatial information: what we know about place cells and what they can

- tell us about presence. *Presence: Teleoperators and Virtual Environments*, 15(5), 485-499. <https://doi.org/10.1162/pres.15.5.485>
- Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry*, 18(4), 211-237. <https://doi.org/10.1080/10478400701598298>
- Bruner, J. S. (1961). *The act of discovery*. Harvard Educational Review.
- Bruner, J. S. (1966). *Toward a theory of instruction*. Belkapp.
- Bruner, J. S. (2009). *The process of education*. Harvard University Press. <https://doi.org/10.2307/j.ctvk12qst>
- Buckley, C. E., Kavanagh, D. O., Traynor, O., & Neary, P. C. (2014). Is the skillset obtained in surgical simulation transferable to the operating theatre? *The American Journal of Surgery*, 207(1), 146-157. <https://doi.org/10.1016/j.amjsurg.2013.06.017>
- Bulu, S. T. (2012). Place presence, social presence, co-presence, and satisfaction in virtual worlds. *Computers & Education*, 58(1), 154-161. <https://doi.org/10.1016/j.compedu.2011.08.024>
- Buń, P., Górski, F., Wichniarek, R., Kuczko, W., Hamrol, A., & Zawadzki, P. (2015). Application of professional and low-cost head mounted devices in immersive educational application. *Procedia Computer Science*, 75, 173-181. <https://doi.org/10.1016/j.procs.2015.12.235>
- Burdea, G. (2002). Keynote address: Virtual rehabilitation-benefits and challenges. *Proceedings of the 1st International Workshop on Virtual Reality Rehabilitation (Mental Health, Neurological, Physical, Vocational) VRMHR (vol. 2002)*, 1-11.
- Burdea, G., & Coiffet, P. (2003). *Virtual reality technology* (2nd ed.). John Wiley. <https://doi.org/10.1162/105474603322955950>
- Bush, J. (2008). Viability of virtual reality exposure therapy as a treatment alternative. *Computers in Human Behavior*, 24(3), 1032-1040. <https://doi.org/10.1016/j.chb.2007.03.006>
- Buttussi, F., & Chittaro, L. (2017). Effects of different types of virtual reality display on presence and learning in a safety training scenario. *IEEE Transactions on Visualization and Computer Graphics*, 24(2), 1063-1076. <https://doi.org/10.1109/TVCG.2017.2653117>
- Cali, C., Baghabra, J., Boges, D. J., Holst, G. R., Kreshuk, A., Hamprecht, F. A., Srinivasan, M., Lehvälaiho, H., & Magistretti, P. J. (2015). Three-dimensional immersive virtual reality for studying cellular compartments in 3D models from EM preparations of neural tissues. *Journal of Comparative Neurology*, 524(1), 23-38. <https://doi.org/10.1002/cne.23852>
- Çalışkan, O. (2011). Virtual field trips in education of earth and environmental sciences. *Procedia-Social and Behavioral Sciences*, 15, 3239-3243. <https://doi.org/10.1016/j.sbspro.2011.04.278>

- Callieri, M., Chica, A., Dellepiane, M., Besora, I., Corsini, M., Moyés, J., Ranzuglia, G., Moyés, J., & Brunet, P. (2011). Multiscale acquisition and presentation of very large artifacts: the case of portalada. *Journal on Computing and Cultural Heritage*, 3(4), 1-20. <https://doi.org/10.1145/1957825.1957827>
- Carlson, J. R., & George, J. F. (2004). Media appropriateness in the conduct and discovery of deceptive communication: The relative influence of richness and synchronicity. *Group Decision and Negotiation*, 13(2), 191-210. <https://doi.org/10.1023/B:GRUP.0000021841.01346.35>
- Carnegie, K., & Rhee, T. (2015). Reducing visual discomfort with HMDs using dynamic depth of field. *IEEE Computer Graphics and Applications*, 35(5), 34-41. <https://doi.org/10.1109/MCG.2015.98>
- Carrozzino, M., & Bergamasco, M. (2010). Beyond virtual museums: experiencing immersive virtual reality in real museums. *Journal of Cultural Heritage*, 11(4), 452-458. <https://doi.org/10.1016/j.culher.2010.04.001>
- Castaneda, L. & Pacampara, M. (2016). Virtual Reality in the classroom-An exploration of hardware, management, content and pedagogy. In G. Chamblee & L. Langub (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2016* (pp. 527-534). Association for the Advancement of Computing in Education (AACE).
- Casu, A., Spano, L. D., Sorrentino, F., & Scateni, R. (2015). RiftArt: bringing masterpieces in the classroom through immersive virtual reality. *Proceedings of the Smart Tools and Apps for Graphics-Eurographics Italian Chapter Conference*. Eurographics Association.
- Cendan, J., & Lok, B. (2012). The use of virtual patients in medical school curricula. *Advances in Physiology Education*, 36, 48-53. <https://doi.org/10.1152/advan.00054.2011>
- Chang, X. Q., Zhang, D. H., & Jin, X. X. (2016). Application of virtual reality technology in distance learning. *International Journal of Emerging Technologies in Learning*, 11(11). <https://doi.org/10.3991/ijet.v11i11.6257>
- Chen, S. (2018). Research on the application of virtual reality in remote education based on the example of MOOC. *Proceedings of the 2018 15th International Conference on Service Systems and Service Management (ICSSSM)*, 1-4. IEEE. <https://doi.org/10.1109/ICSSSM.2018.8465027>
- Chen, X., Chen, Z., Li, Y., He, T., Hou, J., Liu, S., & He, Y. (2019). ImmerTai: Immersive motion learning in VR environments. *Journal of Visual Communication and Image Representation*, 58, 416-427. <https://doi.org/10.1016/j.jvcir.2018.11.039>
- Chen, Y. L. (2016). The effects of virtual reality learning environment on student cognitive and linguistic development. *The Asia-Pacific Education Researcher*, 25(4), 637-646. <https://doi.org/10.1007/s40299-016-0293-2>

- Cheng, A., Yang, L., & Andersen, E. (2017). Teaching language and culture with a virtual reality game. *Proceedings of the Conference on Human Factors in Computing Systems, 2017*, 541-549.  
<https://doi.org/10.1145/3025453.3025857>
- Cheng, M. T., She, H. C., & Annetta, L. A. (2015). Game immersion experience: its hierarchical structure and impact on game-based science learning. *Journal of Computer Assisted Learning, 31*(3), 232-253.  
<https://doi.org/10.1111/jcal.12066>
- Cheong, R. (1995). The virtual threat to travel and tourism. *Tourism Management, 16*(6), 417-422. [https://doi.org/10.1016/0261-5177\(95\)00049-T](https://doi.org/10.1016/0261-5177(95)00049-T)
- Chernyak, D., & Stark, L. W. (2001). Top-down guided eye movements. *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics), 31*(4), 514-522. <https://doi.org/10.1109/3477.938257>
- Cheung, S. K. S., Fong, J., Fong, W., Wang, F. L., & Kwok, L. F. (Eds.). (2013). *Hybrid learning and continuing education, Proceedings of the 6th International Conference* (vol. 8038). Springer. <https://doi.org/10.1007/978-3-642-39750-9>
- Chittaro, L., & Buttussi, F. (2015). Assessing knowledge retention of an immersive serious game vs. A traditional education method in aviation safety. *IEEE Transactions on Visualization and Computer Graphics, 21*(4), 529-538. <https://doi.org/10.1109/TVCG.2015.2391853>
- Choi, J. I., & Hannafin, M. (1995). Situated cognition and learning environments: Roles, structures, and implications for design. *Educational Technology Research and Development, 43*(2), 53-69. <https://doi.org/10.1007/BF02300472>
- Christiansen, K. R., & Shalamov, A. (2017). *Motion sensors explainer*. World Wide Web Consortium, Technical Report.
- Chu, P. Y., Chen, L. C., Kung, H. W., & Su, S. J. (2017). A study on the differences among M3D, S3D and HMD for students with different degrees of spatial ability in design education. *Proceedings of the International Conference on Human-Computer Interaction, 293-299*. Springer. [https://doi.org/10.1007/978-3-319-58750-9\\_41](https://doi.org/10.1007/978-3-319-58750-9_41)
- Claessen, M. H., van Der Ham, I. J., Jagersma, E., & Visser-Meily, J. M. (2015). Navigation strategy training using virtual reality in six chronic stroke patients: a novel and explorative approach to the rehabilitation of navigation impairment. *Neuropsychological Rehabilitation, 26*(5-6), 822-846.  
<https://doi.org/10.1080/09602011.2015.1045910>
- Clarke, P. (2016). Smart MEMS microphones market emerges. *EE News Analog*. <https://www.eenewsanalog.com/news/smart-mems-microphones-market-emerges>

- Cockton, G. (2006). Valuing user experience. In E. Law, E. Hvannberg & M. Hasenzahl (Eds.), *Proceedings of the NordiCHI 2006 Workshop: User Experience: Towards a Unified View*, 100-105. COST294-MAUSE.
- Codd, A. M., & Choudhury, B. (2011). Virtual reality anatomy: is it comparable with traditional methods in the teaching of human forearm musculoskeletal anatomy? *Anatomical Sciences Education*, 4(3), 119-125.  
<https://doi.org/10.1002/ase.214>
- Cohen, J. (2001). Defining identification: A theoretical look at the identification of audiences with media characters. *Mass Communication & Society*, 4(3), 245-264. [https://doi.org/10.1207/S15327825MCS0403\\_01](https://doi.org/10.1207/S15327825MCS0403_01)
- Colburn, A. (2000). Constructivism: Science education's "grand unifying theory." *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 74(1), 9-12. <https://doi.org/10.1080/00098655.2000.11478630>
- Computer Discount Warehouse-Government, CDW-G (2010). *21st-century classroom report: Key findings*. <http://newsroom.cdw.com/features/feature-06-28-10.html>
- Conn, C., Lanier, J., Minsky, M., Fisher, S., & Druin, A. (1989). Virtual environments and interactivity: windows to the future. *Proceedings of the ACM SIGGRAPH 89 Panel*, 7-18. ACM. <https://doi.org/10.1145/77276.77278>
- Connolly, M., Seligman, J., Kastenmeier, A., Goldblatt, M., & Gould, J. C. (2014). Validation of a virtual reality-based robotic surgical skills curriculum. *Surgical Endoscopy*, 28(5), 1691-1694. <https://doi.org/10.1007/s00464-013-3373-x>
- Cook, D. A., Erwin, P. J., & Triola, M. M. (2010). Computerized virtual patients in health professions education: a systematic review and meta-analysis. *Academic Medicine*, 85(10), 1589-1602.  
<https://doi.org/10.1097/ACM.0b013e3181edfe13>
- Corbetta, D., Imeri, F., & Gatti, R. (2015). Rehabilitation that incorporates virtual reality is more effective than standard rehabilitation for improving walking speed, balance and mobility after stroke: a systematic review. *Journal of Physiotherapy*, 61(3), 117-124. <https://doi.org/10.1016/j.jphys.2015.05.017181b33350>
- Crescentini, C., Chittaro, L., Capurso, V., Sioni, R., & Fabbro, F. (2016). Psychological and physiological responses to stressful situations in immersive virtual reality: Differences between users who practice mindfulness meditation and controls. *Computers in Human Behavior*, 59, 304-316.  
<https://doi.org/10.1016/j.chb.2016.02.031>
- Crook, C. (1991). Computers in the zone of proximal development: implications for evaluation. *Computers & Education*, 17(1), 81-91.  
[https://doi.org/10.1016/0360-1315\(91\)90075-3](https://doi.org/10.1016/0360-1315(91)90075-3)

- Crook, C., & Lewthwaite, S. (2010). Technologies for formal and informal learning. *International Handbook of Psychology in Education*, 435-461. Emerald
- Cruz-Neira, C., Sandin, D. J., DeFanti, T. A., Kenyon, R. V., & Hart, J. C. (1992). The CAVE: audio visual experience automatic virtual environment. *Communications of the ACM*, 35(6), 64-73. <https://doi.org/10.1145/129888.129892>
- Csikszentmihályi, M. (1990). *Flow: The psychology of optimal experience*. Haper and Row.
- Csikszentmihályi, M. (2017). *Finding flow*. Hachette Audio.
- Cushman, L. A., Stein, K., & Duffy, C. J. (2008). Detecting navigational deficits in cognitive aging and Alzheimer disease using virtual reality. *Neurology*, 71(12), 888-895. <https://doi.org/10.1212/01.wnl.0000326262.67613.fe>
- Dalgarno, B., & Lee, M. J. W. (2010). What are the learning affordances of 3-D virtual environments? *British Journal of Educational Technology*, 41(1), 10-32. <https://doi.org/10.1111/j.1467-8535.2009.01038.x>
- Dalgarno, B., Lee, M. J., Carlson, L., Gregory, S., & Tynan, B. (2011). An Australian and New Zealand scoping study on the use of 3D immersive virtual worlds in higher education. *Australasian Journal of Educational Technology*, 27(1). <https://doi.org/10.14742/ajet.978>
- Darken, R., & Goerger, S. R. (1999). The transfer of strategies from virtual to real environments: an explanation for performance differences? *Simulation Series*, 31, 159-164.
- Daudt, H. M., Van Mossel, C., & Scott, S. J. (2013). Enhancing the scoping study methodology: A large, inter-professional team's experience with Arksey and O'Malley's framework. *BMC Medical Research Methodology*, 13(1), 48. <https://doi.org/10.1186/1471-2288-13-48>
- Davis, A. & Kühnlenz, F. (2017). Optical design using Fresnel lenses: basic principles and some practical examples. *Optik & Photonik*, 4, 52-55. <https://doi.org/10.1002/opph.201190287>
- Davis, D., & Hayes, J. (2012). What are the benefits of mindfulness: A wealth of new research has explored this age-old practice. Here's a look at its benefits for both clients and psychologists. *Monitor on Psychology*, 43, 198-208. <https://doi.org/10.1037/e584442012-022>
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003. <https://doi.org/10.1287/mnsc.35.8.982>
- Dawson, D. L. (2006). Training in carotid artery stenting: do carotid simulation systems really help? *Vascular*, 14(5), 256-263. <https://doi.org/10.2310/6670.2006.00045>

- De la Peña, N., Weil, P., Llobera, J., Giannopoulos, E., Pomés, A., Spanlang, B., Friedman, D., Sanchez-Vives, M. V., & Slater, M. (2010). Immersive journalism: immersive virtual reality for the first-person experience of news. *Presence: Teleoperators and Virtual Environments*, 19(4), 291-301.  
[https://doi.org/10.1162/PRES\\_a\\_00005](https://doi.org/10.1162/PRES_a_00005)
- De Lucia, A., Francese, R., Passero, I., & Tortora, G. (2009). Development and evaluation of a virtual campus on Second Life: The case of Second DMI. *Computers & Education*, 52(1), 220-233.  
<https://doi.org/10.1016/j.compedu.2008.08.001>
- De Oliveira, E. C., Bertrand, P., Lesur, M. E. R., Palomo, P., Demarzo, M., Cebolla, A., Baños, R., & Tori, R. (2016). Virtual body swap: A new feasible tool to be explored in health and education. *Proceedings of the 18th Symposium on Virtual and Augmented Reality, SVR 2016*, 81-89.  
<https://doi.org/10.1109/SVR.2016.23>
- De Rooij, I. J. M., van de Port, I. G. L., & Meijer, J.-W. G. (2016). Effect of virtual reality training on balance and gait ability in patients with stroke: Systematic review and meta-analysis. *Physical Therapy*, 96(12), 1905-1918.  
<https://doi.org/10.2522/ptj.20160054>
- De Villiers, P. & Blignaut, S. (2016). Readiness of forklift operators to train with serious games. In J. Johnston (Ed.), *Proceedings of the EdMedia + Innovate Learning 2016*, 1696-1704. Association for the Advancement of Computing in Education (AACE).
- Dede, C. J. (1992). The future of multimedia: Bridging to virtual worlds. *Educational Technology*, 32(5), 54-60.
- Dede, C. J. (2009). Immersive interfaces for engagement and learning. *Science*, 323, 66-69. <https://doi.org/10.1126/science.1167311>
- Dede, C., Salzman, M., Loftin, R. B., & Ash, K. (1997). Using virtual reality technology to convey abstract scientific concepts. In M. J. Jacobson, R. B. Kozma, & L. Erlbaum (Eds.), *Learning the sciences of the 21st century: research, design, and implementing advanced technology learning environments* (pp. 1-44). Lawrence Erlbaum.
- Dede, C., Salzman, M. C., Loftin, R. B., & Sprague, D. (1999). Multisensory immersion as a modeling environment for learning complex scientific concepts. In W. Feurzeig & N. Roberts (Eds.), *Computer modeling and simulation in science education* (pp. 282-319). Springer. [https://doi.org/10.1007/978-1-4612-1414-4\\_12](https://doi.org/10.1007/978-1-4612-1414-4_12)
- Dennis, A. R., & Valacich, J. S. (1999). Rethinking media richness: Towards a theory of media synchronicity. *Proceedings of the 32nd Hawaii International Conference on Systems Sciences*, 1-10.  
<https://doi.org/10.1109/HICSS.1999.772701>



- Derry, S. J. (1990). *Flexible cognitive tools for problem solving instruction*. Paper presented at the American Educational Research Association.
- Dick, W. (1991). An instructional designer's view of constructivism. *Educational Technology*, 31(5), 41-44.
- Dickey, M. D. (2005). Brave new (interactive) worlds: A review of the design affordances and constraints of two 3D virtual worlds as interactive learning environments. *Interactive Learning Environments*, 13(1-2), 121-137. <https://doi.org/10.1080/10494820500173714>
- Diemer, J., Alpers, G. W., Peperkorn, H. M., Shiban, Y., & Mühlberger, A. (2015). The impact of perception and presence on emotional reactions: a review of research in virtual reality. *Frontiers in Psychology*, 6(26), 1-9. <https://doi.org/10.3389/fpsyg.2015.00026>
- Dodds, T. J., Mohler, B. J., & Bühlhoff, H. H. (2011). Talk to the virtual hands: self-animated avatars improve communication in head-mounted display virtual environments. *PLoS One*, 6(10), e25759. <https://doi.org/10.1371/journal.pone.0025759>
- Doherty, M. E., Jr. (1994). Marshall McLuhan meets William Gibson in "Cyberspace". *CMC Magazine*, 4-5.
- Dolgunsöz, E., Yıldırım, G., & Yıldırım, S. (2018). The effect of virtual reality on EFT writing performance. *Journal of Language and Linguistic Studies*, 14, 278-292.
- Dourish, P. (2004). *Where the action is: the foundations of embodied interaction*. MIT press.
- Duchowski, A. T., House, D. H., Gestring, J., Wang, R. I., Krejtz, K., Krejtz, I., Mantiuk, R., & Bazyluk, B. (2014). Reducing visual discomfort of 3D stereoscopic displays with gaze-contingent depth-of-field. *Proceedings of the ACM Symposium on Applied Perception* (pp. 39-46). ACM. <https://doi.org/10.1145/2628257.2628259>
- Ducoffe, R. H. (1996). Advertising value and advertising on the web-Blog@ management. *Journal of advertising research*, 36(5), 21-32.
- Dunn, S., Woolford, K., Norman, S.-J., White, M., & Barker, L. (2012). Motion in place: a case study of archaeological reconstruction using motion capture. *Revive the Past: Proceedings of the 39th Conference in Computer Applications and Quantitative Methods in Archaeology*, 98-106. Amsterdam University Press. <https://doi.org/10.2307/j.ctt1zrvhmr.14>
- Edmund Optics (n. d.). *Advantages of Fresnel lenses*. <https://www.edmundoptics.com/knowledge-center/application-notes/optics/advantages-of-fresnel-lenses/>
- Edwards, S. (2013). *By-passing the debate: Beyond the "technology question" in the early years*. TACTYC Reflections. <http://tactyc.org.uk/pdfs/Reflection-Edwards.pdf>

- Ehrsson, H. H. (2009). How many arms make a pair? Perceptual illusion of having an additional limb. *Perception*, 38(2), 310-312.  
<https://doi.org/10.1068/p6304>
- Ehrsson, H. H. (2012). The concept of body ownership and its relation to multi-sensory integration. In B. E. Stein (Ed.), *The new handbook of multisensory processes* (pp. 775-792). MIT Press.  
<https://doi.org/10.1162/pres.1996.5.2.247>
- Eichenberg, C. (2011). Application of virtual realities in psychotherapy: possibilities, limitations and effectiveness. In J.-J. Kim (Ed.), *Virtual reality* (pp. 469-484). IntechOpen. <https://doi.org/10.5772/12914>
- El Kabtane, H., El Adnani, M., Sadgal, M., & Mourdi, Y. (2020). Virtual reality and augmented reality at the service of increasing interactivity in MOOCs. *Education and Information Technologies*, 1-27. <https://doi.org/10.1007/s10639-019-10054-w>
- El-Mounayri, H. A., Rogers, C., Fernandez, E., & Satterwhite, J. C. (2016). Assessment of STEM e-learning in an immersive virtual reality (VR) environment. *Proceedings of the ASEE Annual Conference and Exposition*.  
<https://doi.org/10.18260/p.26336>
- Elliman, J., Loizou, M., & Loizides, F. (2016). Virtual reality simulation training for student nurse education. *Proceedings of the 2016 8th International Conference on Games and Virtual Worlds for Serious Applications, VS-Games 2016*.  
<https://doi.org/10.1109/VS-GAMES.2016.7590377>
- Ellis, S. R. (1996). Presence of mind: a reaction to Thomas Sheridan's "further musings on the psychophysics of presence". *Presence: Teleoperators & Virtual Environments*, 5(2), 247-259.  
<https://doi.org/10.1162/pres.1996.5.2.247>
- Elmezeny, A., Edenhofer, N., & Wimmer, J. (2018). Immersive storytelling in 360-degree videos: An analysis of interplay between narrative and technical immersion. *Journal for Virtual Worlds Research*, 11(1).  
<https://doi.org/10.4101/jvwr.v11i1.7298>
- Encyclopaedia Britannica (2020). *Snell's law*. <https://www.britannica.com/science/Snells-law>
- Engadget (2017). *Chinese startup's '8K' VR headset is surprisingly advanced*.  
<https://www.engadget.com/2017-10-12-pimax-8k-vr-headset.html>
- Engelbrecht, H., Lindeman, R. W., & Hoermann, S. (2019). A SWOT analysis of the field of virtual reality for firefighter training. *Frontiers in Robotics and AI* 6(101), 1-14. <https://doi.org/10.3389/frobt.2019.00101>
- Entwistle, N. & Ramsden, P. (2015). *Understanding student learning*. Routledge.  
<https://doi.org/10.4324/9781315718637>

- Ermi, L., & Mäyrä, F. (2005). Fundamental components of the gameplay experience: Analysing immersion. *Worlds in Play: International Perspectives on Digital Games Research*, 37(2), 37-53.
- Ertmer, P. A., & Newby, T. J. (2013). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly*, 26(2), 43-71.  
<https://doi.org/10.1002/piq.21143>
- Ezawa, K., Bazinet, J. B., Danely, C., Gursky, J., Homan, D. F., Kim, H. H., May, M., Pritchard, W. H., Rollins, M., Singlehurst, T. A., Wong, K., Yoshida, R., Chan, D., Goyal, S., Harchandani, A. B., Iyer, R. V., Malik, A., Michaeli, I., Raviv, J., ... & Yang, W. (2016). *Virtual & Augmented Reality. Are you sure it isn't real?* Citi GPS: Global Perspectives & Solutions. <https://www.citibank.com/commercialbank/insights/assets/docs/virtual-and-augmented-reality.pdf>
- Fabola, A., & Miller, A. (2016). Virtual Reality for early education: A study. *Proceedings of the International Conference on Immersive Learning*, 59-72. Springer. [https://doi.org/10.1007/978-3-319-41769-1\\_5](https://doi.org/10.1007/978-3-319-41769-1_5)
- Falah, J., Khan, S., Alfalah, T., Alfalah, S. F. M., Chan, W., Harrison, D. K., & Charisis, V. (2014). Virtual reality medical training system for anatomy education. *Proceedings of the 2014 Science and Information Conference*, 752-758. IEEE. <https://doi.org/10.1109/SAI.2014.6918271>
- Falloon, G. (2010). Using avatars and virtual environments in learning: What do they have to offer?. *British Journal of Educational Technology*, 41(1), 108-122. <https://doi.org/10.1111/j.1467-8535.2009.00991.x>
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G\* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175-191.  
<https://doi.org/10.3758/BF03193146>
- Ferguson, C., Van den Broek, E. L., & Van Oostendorp, H. (2020). On the role of interaction mode and story structure in virtual reality serious games. *Computers & Education*, 143, 103671.  
<https://doi.org/10.1016/j.compedu.2019.103671>
- Ferracani, A., Pezzatini, D., & Del Bimbo, A. (2014). A natural and immersive virtual interface for the surgical safety checklist training. *Proceedings of the ACM International Workshop on Serious Games-Serious Games '14*, 27-32. ACM. <https://doi.org/10.1145/2656719.2656725>
- Fokides, E. (2017a). A model for explaining primary school students' learning outcomes when they use multi-user virtual environments. *Journal of Computers in Education*, 4(3), 225-250. <https://doi.org/10.1007/s40692-017-0080-y>

- Fokides, E. (2017b). Pre-service teachers' intention to use MUVes as practitioners. A structural equation modeling approach. *Journal of Information Technology Education: Research*, 16, 47-68. <https://doi.org/10.28945/3645>
- Fokides, E. (2020). Digital educational games in primary education. Revisiting the results of the research projects of the ETiE initiative. In L. Daniela (Ed.), *Epistemological approaches to digital learning in educational contexts* (pp. 54-68). Routledge. <https://doi.org/10.4324/9780429319501-4>
- Fokides, E., & Atsikpasi, P. (2018). Development of a model for explaining the learning outcomes when using 3D virtual environments in informal learning settings. *Education and Information Technologies*, 25(3), 2265-2287. <https://doi.org/10.1007/s10639-018-9719-1>
- Fokides, E., Atsikpasi, P., Kaimara, P., & Deliyannis, I. (2019). Factors influencing the subjective learning effectiveness of serious games. *Journal of Information Technology Education: Research*, 18, 437-466. <https://doi.org/10.28945/44411>
- Fokides, E., Chronopoulou, M- I., & Kaimara, P. (2019). Comparing videos and a 3D virtual environment for teaching school-related functional skills and behaviors to students with ADHD or developmental dyslexia, displaying challenging behaviors: a case study. *Research and Practice in Technology Enhanced Learning*, 14, 22. <https://doi.org/10.1186/s41039-019-0117-0>
- Fokides, E., & Zampouli, C. (2017). Content and Language Integrated Learning in OpenSimulator Project. Results of a pilot implementation in Greece. *Education and Information Technologies*, 22(4), 1479-1496. <https://doi.org/10.1007/s10639-016-9503-z>
- Foley, J. D., & Van Dam, A. (1982). *Fundamentals of interactive computer graphics* (vol. 2). Addison-Wesley
- Fominykh, M., Prasolova-Førland, E., Stiles, T.C., Krogh, A.B. & Linde, M. (2018). Conceptual framework for therapeutic training with biofeedback in virtual reality: First evaluation of a relaxation simulator. *Journal of Interactive Learning Research*, 29(1), 51-75.
- Forlizzi, J., & Battarbee, K. (2004). Understanding experience in interactive systems. *Proceedings of the 5th Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, 261-268. <https://doi.org/10.1145/1013115.1013152>
- Fowler, C. (2015). Virtual reality and learning: where is the pedagogy? *British Journal of Educational Technology*, 46(2), 412-422. <https://doi.org/10.1111/bjet.12135>
- Fox, J., & Bailenson, J. N. (2009). Virtual self-modeling: the effects of vicarious reinforcement and identification on exercise behaviors. *Media Psychology*, 12(1), 1-25. <https://doi.org/10.1080/15213260802669474>

- Freina, L., Bottino, R. & Tavella, M. (2016). From e-learning to VR-learning: An example of learning in an immersive virtual world. *Journal of e-Learning and Knowledge Society*, 12(2), 101-113.
- Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: state of the art and perspectives. *Proceedings of the International Scientific Conference Elearning and Software for Education*, 1-8.
- Friedman, D., Pizarro, R., Or-Berkers, K., Neyret, S., Pan, X., & Slater, M. (2014). A method for generating an illusion of backwards time travel using immersive virtual reality - an exploratory study. *Frontiers in Psychology*, 5, 943. <https://doi.org/10.3389/fpsyg.2014.00943>
- Friedman, D., Steed, A., & Slater, M. (2007). Spatial social behavior in second life. In C. Pelachaud, J.- C. Martin, E. André, G. Chollet, K. Karpouzis, & D. Pelé (Eds.), *Proceedings of the Intelligent Virtual Agents 7th International Conference, IVA 2007*, 252-263. Springer. [https://doi.org/10.1007/978-3-540-74997-4\\_23](https://doi.org/10.1007/978-3-540-74997-4_23)
- Furrer, C., & Skinner, E. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of Educational Psychology*, 95(1), 148. <https://doi.org/10.1037/0022-0663.95.1.148>
- Gabriel, K., Jarvis, J., & Trimmer, W. (1988). *Small machines, large opportunities: A report on the emerging field of microdynamics*. Report of the Workshop on Microelectromechanical Systems Research. AT&T Bell Laboratories.
- Gaitatzes, A., Christopoulos, D., & Roussou, M. (2001). Reviving the past: cultural heritage meets virtual reality. *Proceedings of the 2001 Conference on Virtual Reality, Archeology, and Cultural Heritage*, 103-110. ACM. <https://doi.org/10.1145/584993.585011>
- Garcia, S., Laesker, D., Andujar, M., Kauer, R., & Nguyen, J. (2019). A virtual reality experience for learning languages. *Proceedings of the Conference on Human Factors in Computing Systems, 2019*. ACM. <https://doi.org/10.1145/3290607.3313253>
- Garrison, D. R. (2011). *E-Learning in the 21st century: A framework for research and practice*. Taylor & Francis. <https://doi.org/10.4324/9780203838761>
- Gartner Glossary (n. d.). *Head-mounted Displays (HMDs)*. <https://www.gartner.com/en/information-technology/glossary/head-mounted-displays-hmd>
- Gavish, N., Gutiérrez, T., Webel, S., Rodríguez, J., Peveri, M., Bockholt, U. & Tecthia, F. (2015). Evaluating virtual reality and augmented reality training for industrial maintenance and assembly tasks. *Interactive Learning Environments*, 23(6), 778-798. <https://doi.org/10.1080/10494820.2013.815221>

- Gavish, N., Gutierrez, T., Webel, S., Rodriguez, J., & Tecchia, F. (2011). Design guidelines for the development of virtual reality and augmented reality training systems for maintenance and assembly tasks. *Proceedings of the International Conference SKILLS 2011*. BIO Web of Conferences. <https://doi.org/10.1051/bioconf/20110100029>
- Gerjets, P., Walter, W., Rosenstiel, W., Bogdan, M., & Zander, T. O. (2014). Cognitive state monitoring and the design of adaptive instruction in digital environments: Lessons learned from cognitive workload assessment using a passive brain-computer interface approach. *Frontiers in Neuroscience*, *8*, 386. <https://doi.org/10.3389/fnins.2014.00385>
- Giannopoulos, E., Wang, Z., Peer, A., Buss, M., & Slater, M. (2011). Comparison of people's responses to real and virtual handshakes within a virtual environment. *Brain Research Bulletin*, *85*(5), 276-282. <https://doi.org/10.1016/j.brainresbull.2010.11.012>
- Gibson, J., J. (1979). *The ecological approach to visual perception*. Psychology Press.
- Glaser, N. J., & Schmidt, M. (2018). Usage considerations of 3D collaborative virtual learning environments to promote development and transfer of knowledge and skills for individuals with autism. *Technology, Knowledge and Learning*, 1-8. <https://doi.org/10.1007/s10758-018-9369-9>
- González-Franco, M., Peck, T. C., Rodríguez-Fornells, A., & Slater, M. (2013). A threat to a virtual hand elicits motor cortex activation. *Experimental Brain Research*, *232*(3), 875-887. <https://doi.org/10.1007/s00221-013-3800-1>
- Górski, F., Buń, P., Wichniarek, R., Zawadzki, P., & Hamrol, A. (2015). Immersive city bus configuration system for marketing and sales education. *Procedia Computer Science*, *75*, 137-146. <https://doi.org/10.1016/j.procs.2015.12.230>
- Gould, N. F., Holmes, M. K., Fantie, B. D., Luckenbaugh, D. A., Pine, D. S., Gould, T. D., Burgess, N., Husseini, D., Manji, K., Carlos, D., & Zarate, A. (2007). Performance on a virtual reality spatial memory navigation task in depressed patients. *American Journal of Psychiatry*, *164*(3), 516-519. <https://doi.org/10.1176/ajp.2007.164.3.516>
- Grant, M., J., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal*, *26*(2), 91-108. <https://doi.org/10.1111/j.1471-1842.2011.00939.x>
- Greenwald, S., Kulik, A., Kunert, A., Beck, S., Frohlich, B., Cobb, S., Parsons, S., Newbutt, N., Gouneia, C., Cook, C., Snyder, A., Payne, S., Holland, J., Buessing, S., Fields, G., Corning, W., Lee, V., Xia, L., & Maes, P. (2017). Technology and applications for collaborative learning in virtual reality. *Proceedings of the 12th International Conference on Computer Supported Collaborative Learning (CSCL), Prioritizing Equity and Access in CSCL*.

- Groom, V., Bailenson, J. N., & Nass, C. (2009). The influence of racial embodiment on racial bias in immersive virtual environments. *Social Influence, 4*(3), 231-248. <https://doi.org/10.1080/15534510802643750>
- Gugenheimer, J., Stemasov, E., Frommel, J., & Rukzio, E. (2017). Sharevr: Enabling co-located experiences for virtual reality between HMD and non-HMD users. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, 4021-4033*. <https://doi.org/10.1145/3025453.3025683>
- Gulikers, J. T., Bastiaens, T. J., & Martens, R. L. (2005). The surplus value of an authentic learning environment. *Computers in Human Behavior, 21*(3), 509-521. <https://doi.org/10.1016/j.chb.2004.10.028>
- Gunawardena, C. N., & Zittle, F. J. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *American Journal of Distance Education, 11*(3), 8-26. <https://doi.org/10.1080/08923649709526970>
- Gustafson, P. (2012). Managing business travel: developments and dilemmas in corporate travel management. *Tourism Management, 33*(2), 276-284. <https://doi.org/10.1016/j.tourman.2011.03.006>
- Guterstam, A., Petkova, V. I., & Ehrsson, H. H. (2011). The illusion of owning a third arm. *PLoS One, 6*(2), e17208. <https://doi.org/10.1371/journal.pone.0017208>
- Gutierrez-Maldonado, J., Andres-Pueyo, A., & Talarn-Caparros, A. (2015). Virtual reality to train teachers in ADHD detection. In D. Rutledge & D. Slykhuis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2015* (pp. 769-772). Association for the Advancement of Computing in Education (AACE).
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: International version* (7th ed.) Pearson. <https://doi.org/10.1016/j.jmva.2009.12.014>
- Halabi, O., Abou El-Seoud, S., Alja'am, J., Alpona, H., Al-Hemadi, M., & Al-Hassan, D. (2017). Design of immersive virtual reality system to improve communication skills in individuals with autism. *International Journal of Emerging Technologies in Learning (IJET), 12*(5), 50-64. <https://doi.org/10.3991/ijet.v12i05.6766>
- Hall, E. T. (1969). *The hidden dimension*. Anchor Books.
- Hamurcu, A. (2018, October). User insights about using immersive virtual reality in industrial design studio courses. *Proceedings of the 2nd International Symposium on Multidisciplinary Studies and Innovative Technologies, 2018*, 1-8. IEEE. <https://doi.org/10.1109/ISMSIT.2018.8567058>

- Harrington, M. C. (2012). The virtual trillium trail and the empirical effects of freedom and fidelity on discovery-based learning. *Virtual Reality, 16*(2), 105-120. <https://doi.org/10.1007/s10055-011-0189-7>
- Hartley, T., Maguire, E. A., Spiers, H. J., & Burgess, N. (2003). The well-worn route and the path less traveled: distinct neural bases of route following and way-finding in humans. *Neuron, 37*(5), 877-888. [https://doi.org/10.1016/S0896-6273\(03\)00095-3](https://doi.org/10.1016/S0896-6273(03)00095-3)
- Hartson, R. & Pyla, P. S. (2012). *The UX Book: Process and guidelines for ensuring a quality user experience*. Elsevier.
- Hassenzahl, M., Tractinsky, N. (2006). User experience-a research agenda. *Behaviour and Information Technology, 25*(2), 91-97. <https://doi.org/10.1080/01449290500330331>
- Hauser, M., Cushman, F., Young, L., Kang-Xing Jin, R., & Mikhail, J. (2007). A dissociation between moral judgments and justifications. *Mind & Language, 22*(1), 1-21. <https://doi.org/10.1111/j.1468-0017.2006.00297.x>
- Hauswiesner, S., Straka, M., & Reitmayr, G. (2011). Free viewpoint virtual try-on with commodity depth cameras. *Proceedings of the 10th International Conference on Virtual Reality Continuum and Its Applications in Industry, 23-30*. ACM. <https://doi.org/10.1145/2087756.2087759>
- Havig, P., McIntire, J., & Geiselman, E. (2011). Virtual reality in a cave: limitations and the need for HMDs? In *Head-and helmet-mounted displays XVI: Design and applications* (vol. 3), 8041-8046). International Society for Optics and Photonics. <https://doi.org/10.1117/12.883855>
- Haworth, M. B., Baljko, M., & Faloutsos, P. (2012). PhoVR. *Proceedings of the 11th ACM SIGGRAPH International Conference on Virtual-Reality Continuum and Its Applications in Industry - VRCAI '12*. <https://doi.org/10.1145/2407516.2407560>
- Headphonezone (2020). *Understanding binaural audio*. <https://www.headphonezone.in/blogs/audiophile-guide/understanding-binaural-audio>
- Held, R. M., & Durlach, N. I. (1992). Telepresence. *Presence: Teleoperators & Virtual Environments, 1*(1), 109-112. <https://doi.org/10.1162/pres.1992.1.1.109>
- Heldal, I., Roberts, D., Bråthe, L., & Wolff, R. (2007). Presence, creativity and collaborative work in virtual environments. *Proceedings of the International Conference on Human-Computer Interaction, 802-811*. Springer. [https://doi.org/10.1007/978-3-540-73105-4\\_88](https://doi.org/10.1007/978-3-540-73105-4_88)
- Heeter, C. (1992). Being there: The subjective experience of presence. *Presence: Teleoperators & Virtual Environments, 1*(2), 262-271. <https://doi.org/10.1162/pres.1992.1.2.262>



- Hew, K. F., & Cheung, W. S. (2010). Use of three-dimensional (3-D) immersive virtual worlds in K-12 and higher education settings: A review of the research. *British Journal of Educational Technology*, *41*(1), 33-55.  
<https://doi.org/10.1111/j.1467-8535.2008.00900.x>
- Higgins, J. P., & Green, S. (Eds.). (2011). *Cochrane handbook for systematic reviews of interventions* (vol. 4). John Wiley & Sons.
- Ho, L. H., Sun, H., & Tsai, T. H. (2019). Research on 3D painting in virtual reality to improve students' motivation of 3D animation learning. *Sustainability*, *11*(6), 1605. <https://doi.org/10.3390/su11061605>
- Hong, S., & Tam, K. (2006). Understanding the adoption of multipurpose information appliances: The case of mobile data services. *Information Systems Research*, *17*, 162-179. <https://doi.org/10.1287/isre.1060.0088>
- Huang, H.-M., Rauch, U., & Liaw, S.-S. (2010). Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. *Computers & Education*, *55*(3), 1171-1182.  
<https://doi.org/10.1016/j.compedu.2010.05.014>
- Hutchins, H. M. (2003). Instructional immediacy and the seven principles: Strategies for facilitating online courses. *Online Journal of Distance Learning Administration*, *6*(3), 1-11.
- Hwang, W. -Y., & Hu, S.-S. (2013). Analysis of peer learning behaviors using multiple representations in virtual reality and their impacts on geometry problem solving. *Computers & Education*, *62*, 308-319.  
<https://doi.org/10.1016/j.compedu.2012.10.005>
- Ihlenfeldt, W. D. (1997). Virtual reality in chemistry. *Molecular Modeling Annual*, *3*(9), 386-402. <https://doi.org/10.1007/s008940050056>
- Ilie, R., Shaffer, E., & D'Angelo, C. M. (2019). Learning by immersion: Developing virtual reality labs for electricity and magnetism courses. *In AGU fall meeting 2019*. AGU. <https://doi.org/10.5194/egusphere-egu2020-6114>
- Ishii, H., & Ullmer, B. (1997). Tangible bits: towards seamless interfaces between people, bits and atoms. *Proceedings of the ACM SIGCHI Conference on Human factors in Computing Systems*, 234-241.  
<https://doi.org/10.1145/258549.258715>
- Jensen, K., Ringsted, C., Hansen, H. J., Petersen, R. H., & Konge, L. (2014). Simulation-based training for thoracoscopic lobectomy: a randomized controlled trial. *Surgical endoscopy*, *28*(6), 1821-1829. <https://doi.org/10.1007/s00464-013-3392-7>
- Jensen, L., & Konradsen, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technologies*, *23*(4), 1515-1529. <https://doi.org/10.1007/s10639-017-9676-0>

- Jensen, M. T. (2014). Exploring business travel with work - family conflict and the emotional exhaustion component of burnout as outcome variables: the job demands-resources perspective. *European Journal of Work and Organizational Psychology, 23*(4), 497-510. <https://doi.org/10.1080/1359432X.2013.787183>
- Jha, M. (2018). *Spinning up in VR-Part 5: Human-computer interaction in virtual reality*. <https://medium.com/@mnrnja007/spinning-up-in-vr-part-5-human-computer-interaction-in-virtual-reality-757242a0751b>
- Johnson-Glenberg, M. C. (2017). Embodied education in mixed and mediated realities. In *Virtual, augmented, and mixed realities in education*, 193-217. Springer. [https://doi.org/10.1007/978-981-10-5490-7\\_11](https://doi.org/10.1007/978-981-10-5490-7_11)
- Johnson-Glenberg, M. C. (2019). The necessary nine: Design principles for embodied VR and active STEM education. In *Learning in a digital world*, 83-112. Springer. [https://doi.org/10.1007/978-981-13-8265-9\\_5](https://doi.org/10.1007/978-981-13-8265-9_5)
- Johnson-Glenberg, M. C., Birchfield, D. A., Tolentino, L., & Koziupa, T. (2014). Collaborative embodied learning in mixed reality motion-capture environments: Two science studies. *Journal of Educational Psychology, 106*(1), 86-104. <https://doi.org/10.1037/a0034008>
- Johnson-Laird, P. N. (1988). *The computer and the mind: An introduction to cognitive science*. Harvard University Press.
- Jonas, J. B., Rabethge, S., & Bender, H. J. (2003). Computer-assisted training system for pars plana vitrectomy. *Acta Ophthalmologica Scandinavica, 81*(6), 600-604. <https://doi.org/10.1046/j.1395-3907.2003.0078.x>
- Jonassen, D. H. (1991). Evaluating constructivistic learning. *Educational technology, 31*(9), 28-33.
- Jonassen, D. H. (1994). Thinking technology: Toward a constructivist design model. *Educational technology, 34*(4), 34-37.
- Jonassen, D. H. (1995). Computers as cognitive tools learning with technology, not from technology. *Journal of Computing in Higher Education, 6*(2), 40-73. <https://doi.org/10.1007/BF02941038>
- Jonassen, D. H., & Carr, C. (2000). Mind tools: Affording multiple knowledge representations in learning. In S. P. Lajoie (Ed.), *Computers as cognitive tools: Volume ii, No more walls* (pp. 165-196). Lawrence Erlbaum Associates Inc. <https://doi.org/10.1201/9781315045337-8>
- Jonassen D. H., Mayes T., McAleese R. (1993) A manifesto for a constructivist approach to uses of technology in higher education. In T. M. Duffy, J. Lowyck, D. H. Jonassen, T. M. Welsh (Eds.), *Designing environments for constructive learning. NATO ASI Series (Series F: Computer and Systems Sciences)* (vol. 105, pp. 231-247). Springer. [https://doi.org/10.1007/978-3-642-78069-1\\_12](https://doi.org/10.1007/978-3-642-78069-1_12)

- Juliano, J. M., Saldana, D., Schmiesing, A., & Liew, S. L. (2019). Experience with head-mounted virtual reality (HMD-VR) predicts transfer of HMD-VR motor skills. *Proceedings of the International Conference on Virtual Rehabilitation (ICVR)*, 1-2. IEEE. <https://doi.org/10.1109/ICVR46560.2019.8994345>
- Kalawsky, R. (1993). *The science of virtual reality and virtual environments: A technical, scientific and engineering reference on virtual environments*. Addison Wesley Publishing Company.
- Kalivarapu, V., Macallister, A., Hoover, M., Sridhar, S., Schlueter, J., Civitate, A., Thompkins, P., Smith, J., Hoyle, J., Oliver, J., Winer, E., & Chernoff, G. (2015). Game-day football visualization experience on dissimilar virtual reality platforms. *Proceedings of the Engineering Reality of Virtual Reality 2015, SPIE* (vol. 9392), 2-14. International Society for Optics and Photonics <https://doi.org/10.1117/12.2083250>
- Kampa, M., & Castanas, E. (2008). Human health effects of air pollution. *Environmental pollution*, 151(2), 362-367. <https://doi.org/10.1016/j.envpol.2007.06.012>
- Kamstrupp, A. K. (2016). The wow-effect in science teacher education. *Cultural Studies of Science Education*, 11(4), 879-897. <https://doi.org/10.1007/s11422-015-9684-6>
- Kandalaft, M. R., Didehbani, N., Krawczyk, D. C., Allen, T. T., & Chapman, S. B. (2012). Virtual reality social cognition training for young adults with high-functioning autism. *Journal of Autism and Developmental Disorders*, 43(1), 34-44. <https://doi.org/10.1007/s10803-012-1544-6>
- Kaplan, A. M., & Haenlein, M. (2016). Higher education and the digital revolution: About MOOCs, SPOCs, social media, and the cookie monster. *Business Horizons*. 59(4), 441-50. <https://doi.org/10.1016/j.bushor.2016.03.008>
- Karageorgakis, T., & Nisiforou, E. A. (2018). Virtual reality in the EFL classroom. *The Cyprus Review*, 30(1), 381-396.
- Karray, F., Alemzadeh, M., Saleh, J. A., & Arab, M. N. (2008). *Human-computer interaction: Overview on state of the art*. *International Journal on Smart Sensing and Intelligent Systems*, 1(1), 137-159. <https://doi.org/10.21307/ijssis-2017-283>
- Kasahara, S., Nagai, S., & Rekimoto, J. (2014). LiveSphere: immersive experience sharing with 360 degrees head-mounted cameras. *Proceedings of the Adjunct Publication of the 27th Annual ACM Symposium on User Interface Software and Technology*, 61-62. ACM. <https://doi.org/10.1145/2658779.2659114>

- Kateros, S., Georgiou, S., Papaefthymiou, M., Papagiannakis, G., & Tsioumas, M. (2015). A comparison of gamified, immersive VR curation methods for enhanced presence and human-computer interaction in digital humanities. *International Journal of Heritage in the Digital Era*, 4(2), 221-233. <https://doi.org/10.1260/2047-4970.4.2.221>
- Kaye, N., & Giannachi, G. (2011). Acts of presence: Performance, mediation, virtual reality. *The Drama Review*, 55(4), 88-95. [https://www.doi.org/10.1162/dram\\_a\\_00124](https://www.doi.org/10.1162/dram_a_00124)
- Kiefer, M., & Trumpp, N. M. (2012). Embodiment theory and education: The foundations of cognition in perception and action. *Trends in Neuroscience and Education*, 1(1), 15-20. <https://doi.org/10.1016/j.tine.2012.07.002>
- Kilteni, K., Bergstrom, I., & Slater, M. (2013). Drumming in immersive virtual reality: the body shapes the way we play. *IEEE Transactions on Visualization and Computer Graphics*, 19(4), 597-605. <https://doi.org/10.1109/TVCG.2013.29>
- Kilteni, K., Normand, J.-M., Sanchez-Vives, M. V., & Slater, M. (2012). Extending body space in immersive virtual reality: a very long arm illusion. *PloS One*, 7(7), e40867. <https://doi.org/10.1371/journal.pone.0040867>
- Kim, J. H., Jang, S. H., Kim, C. S., Jung, J. H., & You, J. H. (2009). Use of virtual reality to enhance balance and ambulation in chronic stroke: A double-blind, randomized controlled study. *American Journal of Physical Medicine & Rehabilitation*, 88(9), 693-701. <https://doi.org/10.1097/phm.0b013e3>
- Kim, J., Kim, H., Tay, B. K., Muniyandi, M., Srinivasan, M. A., Jordon, J., Mortensen, J., Oliveira, M., & Slater, M. (2004). Transatlantic touch: a study of haptic collaboration over long distance. *Presence: Teleoperators & Virtual Environments*, 13(3), 328-337. <https://doi.org/10.1162/1054746041422370>
- Kim, J. S. (1999). Physiology of eye movements. *Annals of Clinical Neurophysiology*, 1(2), 173-181.
- Kim, T., & Biocca, F. (1997). Telepresence via television: Two dimensions of telepresence may have different connections to memory and persuasion. *Journal of Computer-Mediated Communication*, 3(2), JCMC325. <https://doi.org/10.1111/j.1083-6101.1997.tb00073.x>
- King, T. J., Warren, I., & Palmer, D. (2008). Would Kitty Genovese have been murdered in Second Life? Researching the "bystander effect" using online technologies. Proceedings of the *TASA 2008: Re-Imagining Sociology: The Annual Conference of the Australian Sociological Association*, 1-23. Australian Sociological Association.
- Kirschner, P., Strijbos, J. W., Kreijns, K., & Beers, P. J. (2004). Designing electronic collaborative learning environments. *Educational Technology Research and Development*, 52(3), 47. <https://doi.org/10.1007/BF02504674>

- Kleinsmith, A., Rivera-Gutierrez, D., Finney, G., Cendan, J., & Lok, B. (2015). Understanding empathy training with virtual patients. *Computers in Human Behavior*, 52, 151-158. <https://doi.org/10.1016/j.chb.2015.05.033>
- Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford Publications.
- Klippel, A., Oprean, D., Zhao, J., Wallgrün, J. O., LaFemina, P., Jackson, K., & Gowen, E. (2019). Immersive learning in the wild: a progress report. *Proceedings of the International Conference on Immersive Learning*, 3-15. Springer. [https://doi.org/10.1007/978-3-030-23089-0\\_1](https://doi.org/10.1007/978-3-030-23089-0_1)
- Kober, S. E., Wood, G., Hofer, D., Kreuzig, W., Kiefer, M., & Neuper, C. (2013). Virtual reality in neurologic rehabilitation of spatial disorientation *Journal of Neuroengineering and Rehabilitation*, 10(1), 1-13. <https://doi.org/10.1186/1743-0003-10-17>
- Koenig, S. T., Crucian, G. P., Dalrymple-Alford, J. C., & Dunser, A. (2009). Virtual reality rehabilitation of spatial abilities after brain damage. *Annual Review of CyberTherapy and Telemedicine*, 105-107.
- Kohn, A. (2004). The cult of rigor and the loss of joy. *Education Week*, 24(3), 6-8.
- Kokkinara, E., & Slater, M. (2014). Measuring the effects through time of the influence of visuomotor and visuotactile synchronous stimulation on a virtual body ownership illusion. *Perception*, 43(1), 43-58. <https://doi.org/10.1068/p7545>
- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.
- Kolb, A. Y., & Kolb, D. A. (2009). Experiential learning theory: A dynamic, holistic approach to management learning, education and development. *The SAGE handbook of management learning, education and development*, 42-68. <https://doi.org/10.4135/9780857021038.n3>
- Koleva, B., Taylor, I., Benford, S., Fraser, M., Greenhalgh, C., Schnadelbach, H., Lehn, D. v., Heath, C., Row-Far, J., & Adams, M. (2001). Orchestrating a mixed reality performance. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 38-45. SIGCHI <https://doi.org/10.1145/365024.365033>
- Kozlov, M. D., & Johansen, M. K. (2010). Real behavior in virtual environments: psychology experiments in a simple virtual-reality paradigm using video games. *Cyberpsychology, behavior, and social networking*, 13(6), 711-714. <https://doi.org/10.1089/cyber.2009.0310>
- Krassmann, A. L., da Rocha Mazzuco, A. E., Melo, M., Bessa, M., & Bercht, M. (2020). Usability and sense of presence in virtual worlds for distance education: A case study with virtual reality experts. *Proceedings of the 12th International Conference on Computer Supported Education (CSEDU)*, 155-162. Science and Technology Publications. <https://doi.org/10.5220/0009350401550162>

- Krokos, E., Plaisant, C., & Varshney, A. (2019). Virtual memory palaces: Immersion aids recall. *Virtual Reality*, 23(1), 1-15. <https://doi.org/10.1007/s10055-018-0346-3>
- Krueger, M. W., 1992. An Architecture for artificial realities. *Proceedings of the 37<sup>th</sup> IEEE Computer Society International Conference (COMPCON'92)*, 462-465. IEEE.
- Kucirkova, N. (2014). Kindle vs books? Children just don't see it that way. *The Conversation*, 18.
- Kwon, C. (2019). Verification of the possibility and effectiveness of experiential learning using HMD-based immersive VR technologies. *Virtual Reality*, 23(1), 101-118. <https://doi.org/10.1007/s10055-018-0364-1>
- Lakoff, G. & Johnson, M. (1999). *Philosophy in the flesh: the embodied mind and its challenge to Western thought*. Basic Books.
- Lakoff, G. & Núñez, R. E. (2000). *Where mathematics comes from: How the embodied mind brings mathematics into being*. Basic Books.
- Lamson, R. J. (1997). *Virtual therapy: prevention and treatment of psychiatric conditions by immersion in virtual reality environments*. Presses Polytechnique de Montréal.
- Lanier, J. (2006). Homuncular flexibility. *Edge*, 26. <https://www.edge.org/response-detail/11182>
- Lanier, J. (2010). *You are not a gadget: A manifesto*. Random House.
- Latane, B., & Darley, J. M. (1968). Group inhibition of bystander intervention in emergencies. *Journal of Personality and Social Psychology*, 10(3), 215. <https://doi.org/10.1037/h0026570>
- Lawson, G., Salanitri, D., & Waterfield, B. (2016). Future directions for the development of virtual reality within an automotive manufacturer. *Applied Ergonomics*, 53, 323-330. <https://doi.org/10.1016/j.apergo.2015.06.024>
- Lee, B., & Wong, C. (2008). Transition to comprehensive student guidance service in Hong Kong. *Counselling, Psychotherapy, and Health, Counselling in the Asia Pacific Rim: A Coming Together of Neighbours Special Issue 4(1)*, 17-23.
- Lee, E. A. L., Wong, K. W., & Fung, C. C. (2010). How does desktop virtual reality enhance learning outcomes? A structural equation modeling approach. *Computers & Education*, 55(4), 1424-1442. <https://doi.org/10.1016/j.compedu.2010.06.006>
- Lee, H. J., Lee, K. H., & Choi, J. (2018). A structural model for Unity of experience: Connecting user experience, customer experience, and brand experience. *Journal of Usability Studies*, 14(1), 8-34.
- Lee, K. M. (2004). Presence, explicated. *Communication Theory*, 14(1), 27-50. <https://doi.org/10.1111/j.1468-2885.2004.tb00302.x>

- Leinen, P., Green, M. F., Esat, T., Wagner, C., Tautz, F. S., & Temirov, R. (2015). Virtual reality visual feedback for hand-controlled scanning probe microscopy manipulation of single molecules. *Beilstein Journal of Nanotechnology*, 6(1), 2148-215. <https://doi.org/10.3762/bjnano.6.220>
- Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). *Scoping studies: Advancing the methodology. Implementation Science*, 5(1), 69. <https://doi.org/10.1186/1748-5908-5-69>
- Levin, M. F. (2011). Can virtual reality offer enriched environments for rehabilitation? *Expert Review of Neurotherapeutics*, 11(2), 153-155. <https://doi.org/10.1586/ern.10.201>
- Levoy, M., Pulli, K., Curless, B., Rusinkiewicz, S., Koller, D., Pereira, L., Ginzton, M., Anderson, S., Davis, J., Ginsberg, J., Shade, J. & Fulk, D. (2000). The digital Michelangelo project: 3D scanning of large statues. *Proceedings of the 27th Annual Conference on Computer Graphics and Interactive Techniques*, 131-144. ACM Press/Addison-Wesley Publishing Co. <https://doi.org/10.1145/344779.344849>
- Lewis, P. H., (1994, September). Sound Bytes; He added "Virtual" to "Reality." *The New York Times*, 7. <https://www.nytimes.com/1994/09/25/business/sound-bytes-he-added-virtual-to-reality.html>
- Liang, H. N., Lu, F., Shi, Y., Nanjappan, V., & Papangelis, K. (2019). Evaluating the effects of collaboration and competition in navigation tasks and spatial knowledge acquisition within virtual reality environments. *Future Generation Computer Systems*, 95, 855-866. <https://doi.org/10.1016/j.future.2018.02.029>
- Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Medicine*, 6(7), e1000100. <https://doi.org/10.1371/journal.pmed.1000100>
- Limniou, M., Roberts, D., & Papadopoulos, N. (2008). Full immersive virtual environment CAVETM in Chemistry education. *Computer & Education*, 51, 584-593. <https://www.doi.org/10.1016/j.compedu.2007.06.014>
- Lin, H., Chen, M., Lu, G., Zhu, Q., Gong, J., You, X., Wen, Y., Xu, B., & Hu, M. (2013). Virtual Geographic Environments (VGEs): a new generation of geographic analysis tool. *Earth-Science Reviews*, 126, 74-84. <https://doi.org/10.1016/j.earscirev.2013.08.001>
- Lin, S, Lee, T., Wang, H., & Chan, H. (2018). Developing the immersion virtual reality platform based on experiential learning cycle-using fire disaster pre-

- vention education as an example. *Proceedings of the 7th International Congress on Advanced Applied Informatics*, IIAI-AAI 2018, 948-949. <https://doi.org/10.1109/IIAI-AAI.2018.00195>
- Lindgren, R., & Johnson-Glenberg, M. (2013). Emboldened by embodiment: Six precepts for research on embodied learning and mixed reality. *Educational Researcher*, 42(8), 445-452. <https://doi.org/10.3102/0013189X13511661>
- Lindgren, R., Tscholl, M., Wang, S., & Johnson, E. (2016). Enhancing learning and engagement through embodied interaction within a mixed reality simulation. *Computers & Education*, 95, 174-187. <https://doi.org/10.1016/j.compedu.2016.01.001>
- Linnenbrink, E. A., & Pintrich, P. R. (2002). Motivation as an enabler for academic success. *School Psychology Review*, 31(3), 313-327. <https://doi.org/10.1080/02796015.2002.12086158>
- Liu, D., Jenkins, S. A., Sanderson, P. M., Fabian, P., & Russell, W. J. (2010). Monitoring with head-mounted displays in general anesthesia: A clinical evaluation in the operating room. *Anesthesia & Analgesia*, 110(4), 1032-1038. <https://doi.org/10.1213/ANE.0b013e3181d3e647>
- Liu, Y. (2017). Bringing VR to your class/school: Where to start. In J. Johnston (Ed.), *Proceedings of the EdMedia + Innovate Learning 2017* (pp. 963-967). Association for the Advancement of Computing in Education (AACE).
- Liu, Y., Fan, X., Zhou, X., Liu, M., Wang, J., & Liu, T. (2019). Application of virtual reality technology in distance higher education. *Proceedings of the 2019 4th International Conference on Distance Education and Learning*, 35-39. <https://doi.org/10.1145/3338147.3338174>
- Livingstone, S., Wijnen, C. W., Papaioannou, T., Costa, C., & del Mar Grandío, M. (2013). Situating media literacy in the changing media environment: critical insights from European research on audiences. In N. Carpentier, C. Schrøder, & L. Hallett (Eds.), *Audience transformations: shifting audience positions in late modernity, Vol. 1 Routledge studies in European communication research and education* (pp. 210-228). Routledge.
- Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication*, 3(2), <https://doi.org/10.1111/j.1083-6101.1997.tb00072.x>
- Loizides, F., El Kater, A., Terlikas, C., Lanitis, A., & Michael, D. (2014). Presenting Cypriot cultural heritage in virtual reality: a user evaluation. *Proceedings of the Euro-Mediterranean Conference*, 572-579. Springer. [https://doi.org/10.1007/978-3-319-13695-0\\_57](https://doi.org/10.1007/978-3-319-13695-0_57)
- Loomis, J. M. (1992). Distal attribution and presence. *Presence: Teleoperators & Virtual Environments*, 1(1), 113-119. <https://doi.org/10.1162/pres.1992.1.1.113>



- Lorello, G., Cook, D., Johnson, R., & Brydges, R. (2014). Simulation-based training in anaesthesiology: a systematic review and meta-analysis. *British Journal of Anaesthesia*, *112*(2), 231-245. <https://doi.org/10.1093/bja/aet414>
- Loup, G., Serna, A., Iksal, S., & George, S. (2016). Immersion and persistence: Improving learners' engagement in authentic learning situations. *Proceedings of the European Conference on Technology Enhanced Learning*, 410-415. Springer. [https://doi.org/10.1007/978-3-319-45153-4\\_35](https://doi.org/10.1007/978-3-319-45153-4_35)
- Lovden, M., Schaefer, S., Noack, H., Bodammer, N. C., Kuhn, S., Heinze, H. J., Düzel, E., Bäckman, L., & Lindenberger, U. (2012). Spatial navigation training protects the hippocampus against age-related changes during early and late adulthood. *Neurobiology of Aging*, *33*(3), 620-629. <https://doi.org/10.1016/j.neurobiolaging.2011.02.013>
- Macpherson, C., & Keppell, M. (1998). Virtual reality: What is the state of play in education? *Australasian Journal of Educational Technology*, *14*(1), 60-74. <https://doi.org/10.14742/ajet.1929>
- MacLeod, M. A. M. D., & McLeod, D. B. (1996). *Immersed in technology: art and virtual environments*. MIT Press.
- Magenat-Thalmann, N., Kevelham, B., Volino, P., Kasap, M., & Lyard, E. (2011). 3D web-based virtual try on of physically simulated clothes. *Computer-Aided Design and Applications*, *8*(2), 163-174. <https://doi.org/10.3722/cadaps.2011.163-174>
- Makransky, G., & Lilleholt, L. (2018). A structural equation modeling investigation of the emotional value of immersive virtual reality in education. *Educational Technology Research and Development*, *1*(24). <https://doi.org/10.1007/s11423-018-9581-2>
- Makransky, G., Terkildsen, T. S., & Mayer, R. E. (2017). Adding immersive virtual reality to a science lab simulation causes more presence but less learning. *Learning and Instruction*, *60*, 225-236. <https://doi.org/10.1016/j.learninstruc.2017.12.007>
- Manches, A., O'Malley, C., & Benford, S. (2010). The role of physical representations in solving number problems: A comparison of young children's use of physical and virtual materials. *Computers & Education*, *54*(3), 622-640. <https://doi.org/10.1016/j.compedu.2009.09.023>
- Marco, J. H., Perpiñá, C., & Botella, C. (2013). Effectiveness of cognitive behavioral therapy supported by virtual reality in the treatment of body image in eating disorders: One year follow-up. *Psychiatry Research*, *209*(3), 619-625. <https://doi.org/10.1016/j.psychres.2013.02.023>
- Maselli, A., & Slater, M. (2014). Sliding perspectives: dissociating ownership from self-location during full body illusions in virtual reality. *Frontiers in Human Neuroscience*, *8*, 693. <https://doi.org/10.3389/fnhum.2014.00693>

- Mays, N., Roberts, E., & Popay, J. (2001). Synthesizing research evidence. In N. Fulop, P. Allen, A. Clarke, & N. Black (Eds.), *Studying the organisation and delivery of health services: Research methods* (pp. 188-219). Routledge.
- McIntire, J. P., Havig, P. R., & Geiselman, E. E. (2014). Stereoscopic 3D displays and human performance: A comprehensive review. *Displays*, *35*(1), 18-26. <https://doi.org/10.1016/j.displa.2013.10.004>
- McCall, C., Blascovich, J., Young, A., & Persky, S. (2009). Proxemic behaviors as predictors of aggression towards Black (but not White) males in an immersive virtual environment. *Social and Personality Psychology Compass*, *3*(5), 744-758. <https://doi.org/10.1111/j.1751-9004.2009.00195.x>
- McIntosh, I. A. N., & Wright, S. (2019). Exploring what the notion of "lived experience" offers for social policy analysis. *Journal of Social Policy*, *48*(3), 449-467. <https://doi.org/10.1017/S0047279418000570>
- McKenzie, S., Rough, J., Spence, A., & Patterson, N. (2019). Virtually there: The potential, process and problems of using 360 video in the classroom. *Issues in Informing Science and Information Technology*, *16*, 211-219. <https://doi.org/10.28945/4318>
- McLellan, H. (2004). Virtual realities. In D. H. Jonassen (Ed.), *Handbook of research on educational communications and technology*. Erlbaum Associates.
- McMahan, A. (2003). Immersion, engagement, and presence: A method for analyzing 3-D video games. In *The video game theory reader*, 67-86. Routledge.
- Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A metaanalysis. *Computers & Education*, *70*, 29-40. <https://doi.org/10.1016/j.compedu.2013.07.033>
- Merry, S. N., Stasiak, K., Shepherd, M., Frampton, C., Fleming, T., & Lucassen, M. F. G. (2012). The effectiveness of SPARX, a computerised self help intervention for adolescents seeking help for depression: randomised controlled non-inferiority trial. *BMJ*, *344*(apr18 3), e2598–e2598. <https://doi.org/10.1136/bmj.e2598>
- Mikropoulos, T. A. (2006). Presence: a unique characteristic in educational virtual environments. *Virtual Reality*, *10*(3), 197-206. <https://doi.org/10.1007/s10055-006-0039-1>
- Mikropoulos, T. A. & Bellou, J. (2006). The unique features of educational virtual environments. In P. Isaias, M. McPherson, & F. Banister (Eds.), *Proceedings of e-society 2006, International Association for Development of the Information Society* (vol. 1), 122-128. IADIS.
- Mikropoulos, T. A., & Natsis, A. (2011). Educational virtual environments: A ten-year review of empirical research (1999-2009). *Computers & Education*, *56*(3), 769-780. <https://doi.org/10.1016/j.compedu.2010.10.020>

- Miles, H. C., Pop, S. R., Watt, S. J., Lawrence, G. P., & John, N. W. (2012). A review of virtual environments for training in ball sports. *Computers & Graphics, 36*(6), 714-726. <https://doi.org/10.1016/j.cag.2012.04.007>
- Milgram, P. & Kishino, A. F. (1994). Taxonomy of mixed reality visual displays. *IEICE Transactions on Information and Systems, 1321-1329*.
- Milgram, S. (1974). *Obedience to authority*. McGraw Hill.
- Mills, C., Fridman, I., Soussou, W., Waghray, D., Olney, A. M., & D'Mello, S. K. (2017). Put your thinking cap on: Detecting cognitive load using EEG during learning. *Proceedings of the 7th International Learning Analytics & Knowledge Conference*, 80-89. ACM. <https://doi.org/10.1145/3027385.3027431>
- Moesgaard, T., Fiss, J., Warming, C., Klubien, J., & Schoenau-Fog, H. (2015). Implicit and explicit information mediation in a virtual reality museum installation and its effects on retention and learning outcomes. *Proceedings of the European Conference on Games Based Learning*, 387-394.
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G. (2009). *Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement*. *PLoS Med 6*(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- Mollen, A., & Wilson, H. (2010). Engagement, telepresence and interactivity in online consumer experience: Reconciling scholastic and managerial perspectives. *Journal of Business Research, 63*(9-10), 919-925. <https://doi.org/10.1016/j.jbusres.2009.05.014>
- Moon, J. A. (2013). *A handbook of reflective and experiential learning: Theory and practice*. Routledge. <https://doi.org/10.4324/9780203416150>
- Moreno, R., & Mayer, R. E. (2002). Learning science in virtual reality multimedia environments: Role of methods and media. *Journal of Educational Psychology, 94*(3), 598-610. <https://doi.org/10.1037/0022-0663.94.3.598>
- Moro, C., Štromberga, Z., Raikos, A., & Stirling, A. (2017a). The effectiveness of virtual and augmented reality in health sciences and medical anatomy. *Anatomical Sciences Education, 10*(6), 549-559. <https://doi.org/10.1002/ase.1696>
- Moro, C., Štromberga, Z., & Stirling, A. (2017b). Virtualisation devices for student learning: Comparison between desktop-based (Oculus Rift) and mobile-based (Gear VR) virtual reality in medical and health science education. *Australasian Journal of Educational Technology, 33*(6). <https://doi.org/10.14742/ajet.3840>
- Muhanna, M. A. (2015). Virtual reality and the CAVE: Taxonomy, interaction challenges and research directions. *Journal of King Saud University-Computer and Information Sciences, 27*(3), 344-361. <https://doi.org/10.1016/j.jksuci.2014.03.023>

- Munakata, Y. (2006). Information processing approaches to development. In D. Kuhn, R. S. Siegler, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Cognition, perception, and language* (pP. 426-463). John Wiley & Sons Inc.
- Munn, Z., Peters, M. D. J., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*, 18(1), 1-7. <https://doi.org/10.1186/s12874-018-0611-x>
- Müns, A., Meixensberger, J., & Lindner, D. (2014). Evaluation of a novel phantom-based neurosurgical training system. *Surgical Neurology International*, 5. <https://doi.org/10.4103/2152-7806.146346>
- Murray, J. H. (1997). *Hamlet on the holodeck: The future of narrative in cyberspace*. Free Press.
- Nakatsu, R., & Tosam N. (2005). Active immersion: the goal of communications with interactive agents. *Proceedings of the Fourth International Conference on Knowledge-Based Intelligent Engineering Systems and Allied Technologies*, 85-89.
- Naumann, A., Hurtienne, J., Israel, J. H., Mohs, C., Kindsmüller, M. C., Meyer, H. A., & Hußlein, S. (2007). Intuitive use of user interfaces: defining a vague concept. *Proceedings of the International Conference on Engineering Psychology and Cognitive Ergonomics*, 128-136. Springer. [https://doi.org/10.1007/978-3-540-73331-7\\_14](https://doi.org/10.1007/978-3-540-73331-7_14)
- Navarrete, C. D., McDonald, M. M., Mott, M. L., & Asher, B. (2012). Virtual morality: emotion and action in a simulated three-dimensional "trolley problem." *Emotion*, 12(2), 364. <https://doi.org/10.1037/a0025561>
- Normand, J. M., Giannopoulos, E., Spanlang, B., & Slater, M. (2011). Multisensory stimulation can induce an illusion of larger belly size in immersive virtual reality. *PloS One*, 6(1), e16128. <https://doi.org/10.1371/journal.pone.0016128>
- Norrby, M., Grebner, C., Eriksson, J., & Bostrom, J. (2015). Molecular rift: virtual reality for drug designers. *Journal of Chemical Information and Modeling*, 2015, 55(11), 2475-2484. <https://doi.org/10.1021/acs.jcim.5b00544>
- North, M. M., & North, S. M. (2016). A comparative study of sense of presence of traditional virtual reality and immersive environments. *Australasian Journal of Information Systems*, 20. <https://doi.org/10.3127/ajis.v20i0.1168>
- North, M. M., North, S. M., & Coble, J. R. (1996). *Virtual reality therapy: An innovative paradigm*. Ipi Press.
- Noton, D., & Stark, L. (1971). Eye movements and visual perception. *Scientific American*, 224(6), 34-43.

- Nowak, K. L., & Biocca, F. (2003). The effect of the agency and anthropomorphism on users' sense of telepresence, copresence, and social presence in virtual environments. *Presence: Teleoperators & Virtual Environments*, 12(5), 481-494. <https://www.doi.org/10.1162/105474603322761289>
- Nunez, D. (2004). How is presence in non-immersive, non-realistic virtual environments possible? *Proceedings of the 3rd International Conference on Computer Graphics, Virtual Reality, Visualisation and Interaction in Africa*, 83-86. ACM. <https://doi.org/10.1145/1029949.1029964>
- Olmos, E., Cavalcanti, J. F., Soler, J. L., Contero, M., & Alcañiz, M. (2018). Mobile virtual reality: A promising technology to change the way we learn and teach. *Mobile and Ubiquitous Learning*, 95-106. Springer. [https://doi.org/10.1007/978-981-10-6144-8\\_6](https://doi.org/10.1007/978-981-10-6144-8_6)
- Olmos, H., Gómez, S., Alcañiz, M., Contero, M., Andrés-Sebastiá, M. P., & Martín-Dorta, N. (2015). Combining virtual reality and relaxation techniques to improve attention levels in students from an initial vocational qualification program. In G. Conole G., T. Klobučar, C. Rensing, J. Konert, & E. Lavoué (Eds.), *Design for teaching and learning in a networked world. EC-TEL 2015* (pp. 613-616). Springer. [https://doi.org/10.1007/978-3-319-24258-3\\_71](https://doi.org/10.1007/978-3-319-24258-3_71)
- Oprean, D. (2014). *Understanding the immersive experience: Examining the influence of visual immersiveness and interactivity on spatial experiences and understanding* [Unpublished doctoral dissertation]. University of Missouri.
- Organisation for Economic Co-operation and Development-OECD (2015). *Students, computers and learning: Making the connection*. OECD Publishing.
- Pagé, C., Bernier, P. M., & Trempe, M. (2019). Using video simulations and virtual reality to improve decision-making skills in basketball. *Journal of Sports Sciences*, 37(21), 2403-2410. <https://doi.org/10.1080/02640414.2019.1638193>
- Palanque, P. (Ed.) (2001). Interactive systems. Design, specification, and verification. *Proceedings of the 7th International Workshop, DSV-IS 2000, Revised Papers*. Springer Science & Business Media. <https://doi.org/10.1007/3-540-44675-3>
- Pan, Z., Cheok, A.D., Yang, H., Zhu, J., Shi, J. (2006). Virtual reality and mixed reality for virtual learning environments. *Computers & Graphics*, 30(1), 20-28. <https://doi.org/10.1016/j.cag.2005.10.004>
- Pan, X., & Slater, M. (2011). Confronting a moral dilemma in virtual reality: a pilot study. *Proceedings of the 25th BCS Conference on Human-Computer Interaction*, 46-51. BCS. <https://doi.org/10.14236/ewic/HCI2011.26>
- Pan, X., Slater, M., Beacco, A., Navarro, X., Bllido Rivas, A. I., Swapp, D., Hale, J., Fordes, P. A. G., Denvir, C., Hamilton A. F. de C., & Delacroix, S. (2016). The responses of medical general practitioners to unreasonable patient demand

- for antibiotics - a study of medical ethics using immersive virtual reality. *PLoS One*, 11(2), e0146837. <https://doi.org/10.1371/journal.pone.0146837>
- Pantelidis, V. S. (1993). Virtual reality in the classroom. *Educational Technology*, 33(4), 23-27.
- Papachristos, N. M., Vrellis, I., & Mikropoulos, T. A. (2017). A comparison between Oculus Rift and a low-cost smartphone VR headset: Immersive user experience and learning. *Proceedings of the IEEE 17th International Conference on Advanced Learning Technologies (ICALT 2017)*, 477-481. IEEE. <https://doi.org/10.1109/ICALT.2017.145>
- Papadakis, G., Mania, K., & Koutroulis, E. (2011). A system to measure, control and minimize end-to-end head tracking latency in immersive simulations. *Proceedings of the 10th International Conference on Virtual Reality Continuum and Its Applications in Industry*, 581-584. ACM. <https://doi.org/10.1145/2087756.2087869>
- Papert, S. (1980). *Mindstorm-children, computers, and powerful ideas*. Basic Books.
- Papert, S. (1991). Situating constructionism. In S. Papert & I. Harel (Eds.), *Constructionism*. Ablex.
- Park, B., Knörzer, L., Plass, J. L., & Brünken, R. (2015). Emotional design and positive emotions in multimedia learning: An eyetracking study on the use of anthropomorphisms. *Computers & Education*, 86, 30-42. <https://doi.org/10.1016/j.compedu.2015.02.016>
- Park, M. J., Kim, D. J., Lee, U., Na, E. J., & Jeon, H. J. (2019). A literature overview of virtual reality (VR) in treatment of psychiatric disorders: Recent advances and limitations. *Frontiers in Psychiatry*, 10. <https://doi.org/10.3389/fpsy.2019.00505>
- Parmar, D., Bertrand, J., Babu, S. V., Madathil, K., Zelaya, M., Wang, T., Wagner, J., Gramopadhye, A. K., & Frady, K. (2016). A comparative evaluation of viewing metaphors on psychophysical skills education in an interactive virtual environment. *Virtual Reality*, 20(3), 141-157. <https://doi.org/10.1007/s10055-016-0287-7>
- Parsons, T. D., & Rizzo, A. A. (2008). Affective outcomes of virtual reality exposure therapy for anxiety and specific phobias: A meta-analysis. *Journal of Behavior Therapy and Experimental Psychiatry*, 39(3), 250-261. <https://doi.org/10.1016/j.jbtep.2007.07.007>
- Passig, D., Tzuriel, D., & Eshel-Kedmi, G. (2016). Improving children's cognitive modifiability by dynamic assessment in 3D immersive virtual reality environments. *Computers & Education*, 95, 296-308. <https://doi.org/10.1016/j.compedu.2016.01.009>

- Pham, M. T., Rajić, A., Greig, J. D., Sargeant, J. M., Papadopoulos, A., & McEwen, S. A. (2014). A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Research Synthesis Methods, 5*(4), 371-385. <https://doi.org/10.1002/jrsm.1123>
- Pearson, A. (2004). Balancing the evidence: incorporating the synthesis of qualitative data into systematic reviews. *JBI Reports, 2*, 45-64. <https://doi.org/10.1111/j.1479-6988.2004.00008.x>
- Peck, T. C., Seinfeld, S., Aglioti, S. M., & Slater, M. (2013). Putting yourself in the skin of a black avatar reduces implicit racial bias. *Consciousness and Cognition, 22*(3), 779-787. <https://doi.org/10.1016/j.concog.2013.04.016>
- Penland, J. L., Laviers, K., Bassham, E., & Nnochiri, V. (2019). Virtual learning: a study of virtual reality for distance education. In *Handbook of research on blended learning pedagogies and professional development in higher education*, 156-176. IGI Global. <https://doi.org/10.4018/978-1-5225-5557-5.ch009>
- Pennestri, E., Cavacece, M., & Vita, L. (2005). On the computation of degrees-of-freedom: a didactic perspective. *Proceedings of the 2005 ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC'05)* (vol. 6), 1733-1741. <https://doi.org/10.1115/DETC2005-84109>
- Petrakou, A. (2010). Interacting through avatars: Virtual worlds as a context for online education. *Computers & Education, 54*(4), 1020-1027. <https://doi.org/10.1016/j.compedu.2009.10.007>
- Pimentel, K., & Teixeira, K. (1993). *Virtual Reality: Through the new looking glass*. Intel Windcrest.
- Pirker, J., Lesjak, I., & Guetl, C. (2017). Maroon VR: A room-scale physics laboratory experience. *Proceedings of the IEEE 17th International Conference on Advanced Learning Technologies (ICALT 2017)*, 482-484. IEEE. <https://doi.org/10.1109/ICALT.2017.92>
- Pirker, J., Lesjak, I., Parger, M., & Gütl, C. (2018). An educational physics laboratory in mobile versus room scale virtual reality-A comparative study. In *Online engineering & Internet of things*, 1029-1043. Springer. [https://doi.org/10.1007/978-3-319-64352-6\\_95](https://doi.org/10.1007/978-3-319-64352-6_95)
- Pizarro, R., Hall, M., Bermell-Garcia, P., & González-Franco, M. (2015). Augmenting remote presence for interactive dashboard collaborations. *Proceedings of the 2015 International Conference on Interactive Tabletops & Surfaces*, 235-240. ACM. <https://doi.org/10.1145/2817721.2823486>
- Pollard, K. A., Oiknine, A. H., Files, B. T., Sinatra, A. M., Patton, D., Ericson, M., Thomas, J., & Khooshabeh, P. (2020). Level of immersion affects spatial learning in virtual environments: results of a three-condition within-subjects study with long intersession intervals. *Virtual Reality*, 1-14. <https://doi.org/10.1007/s10055-019-00411-y>

- Pomes, A., & Slater, M. (2013). Drift and ownership towards a distant virtual body. *Frontiers in Human Neuroscience*, 7, 908.  
<https://doi.org/10.3389/fnhum.2013.00908>
- Porcino, T. M., Clua, E., Trevisan, D., Vasconcelos, C. N., & Valente, L. (2017). Minimizing cyber sickness in head mounted display systems: design guidelines and applications. *Proceedings of the 5th International Conference on Serious Games and Applications for Health (SeGAH)*, (pp. 1-6). IEEE.  
<https://doi.org/10.1109/SeGAH.2017.7939283>
- Prabhat, P., Forsberg, A., Katzourin, M., Wharton, K., & Slater, M. (2008). A comparative study of desktop, Fishtank, and CAVE systems for the exploration of volume rendered confocal data sets. *IEEE Transactions on Visualization and Computer Graphics*, 14(3), 551-563.  
<https://doi.org/10.1109/TVCG.2007.70433>
- Prensky, M. (2001). *Digital game-based learning*. McGraw Hill
- Psotka J. (1996). *Immersive tutoring systems, virtual reality and education and training*. U.S. Army Research Institute, ATTN, PERI-IIC
- Pulijala, Y., Ma, M., Pears, M., Peebles, D., & Ayoub, A. (2018). An innovative virtual reality training tool for orthognathic surgery. *International Journal of Oral and Maxillofacial Surgery*, 47(9), 1199-1205.  
<https://doi.org/10.1016/j.ijom.2018.01.005>
- Pulijala, Y., Ma, M., Pears, M., Peebles, D., & Ayoub, A. (2018). Effectiveness of immersive virtual reality in surgical training-A randomized control trial. *Journal of Oral and Maxillofacial Surgery*, 76(5), 1065-1072.  
<https://doi.org/10.1016/j.joms.2017.10.002>
- Qualcomm (n. d.). *Snapdragon XR1 platform*. <https://www.qualcomm.com/products/snapdragon-xr1-platform>
- Queiroz, A. C. M., Nascimento, A. M., Tori, R., & da Silva Leme, M. I. (2018). Using HMD-based immersive virtual environments in primary/K-12 education. *Proceedings of the International Conference on Immersive Learning*, 160-173. Springer. [https://doi.org/10.1007/978-3-319-93596-6\\_11](https://doi.org/10.1007/978-3-319-93596-6_11)
- Quinn, F., & Lyons, T. (2013). Educating for sustainability in virtual worlds: Does the virtual have value? Strand 9 Environmental. *Health and Outdoor Science Education*, 118.
- Rauter, G., Sigrist, R., Koch, C., Crivelli, F., van Raai, M., Riener, R., & Wolf, P. (2013). Transfer of complex skill learning from virtual to real rowing. *PloS One*, 8(12), e82145. <https://doi.org/10.1371/journal.pone.0082145>
- Rebelo, F., Noriega, P., Duarte, E., & Soares, M. (2012). Using virtual reality to assess user experience. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 54(6), 964-982.  
<https://www.doi.org/10.1177/0018720812465006>



- Reford, L., & Leston, J. (2011). *WWF UK policy position statement on business travel*. Worldwide Wildlife Foundation. [http://assets.wwf.org.uk/downloads/business\\_travel\\_ps\\_0709.pdf](http://assets.wwf.org.uk/downloads/business_travel_ps_0709.pdf)
- Reger, G. M., Gahm, G. A., Rizzo, A. A., Swanson, R., & Duma, S. (2009). Soldier evaluation of the virtual reality Iraq. *Telemedicine and e-Health*, 15(1), 101-104. <https://doi.org/10.1089/tmj.2008.0050>
- Ritter III, K. A., Borst, C. W., & Chambers, T. L. (2018). Virtual solar energy center case studies. *Computers in Education Journal*, 9(3), 1-7.
- Rizzo, A., Hartholt, A., Grimani, M., Leeds, A., & Liewer, M. (2014). Virtual reality exposure therapy for combat-related posttraumatic stress disorder. *Computer*, 47(7), 31-37. <https://doi.org/10.1109/MC.2014.199>
- Rizzo, A. A., Buckwalter, J. G., & Neumann, U. (1997). Virtual reality and cognitive rehabilitation: A brief review of the future. *The Journal of Head Trauma Rehabilitation*. <https://doi.org/10.1097/00001199-199712000-00002>
- Rizzo, A. S., Difede, J., Rothbaum, B. O., Reger, G., Spitalnick, J., Cukor, J., & Mclay, R. (2010). Development and early evaluation of the virtual Iraq/Afghanistan exposure therapy system for combat-related PTSD. *Annals of the New York Academy of Sciences*, 1208(1), 114-125. <https://doi.org/10.1111/j.1749-6632.2010.05755.x>
- Road to VR (2019). *Snapdragon XR2 chip to enable standalone headsets with 3Kx3K resolution & 7 cameras*. <https://www.roadtovr.com/qualcomm-snapdragon-xr2-5g-announcement/>
- Roblyer, M. D., & Doering, A. H. (2012). *Integrating educational technology into teaching*. Pearson.
- Ropelato, S., Zünd, F., Magnenat, S., Menozzi, M., & Sumner, R. (2018). Adaptive tutoring on a virtual reality driving simulator. *International Series on Information systems and management in creative Emedia (CreMedia)*, 2017(2), 12-17.
- Rothman, D. B., & Warren, W. H. (2006). Wormholes in virtual reality and the geometry of cognitive maps. *Journal of Vision*, 6(6), 143-143. <https://doi.org/10.1167/6.6.143>
- Roussou, M. (2009). A VR playground for learning abstract mathematics concepts. *IEEE Computer Graphics and Applications*, 29(1), 82-85. <https://doi.org/10.1109/MCG.2009.1>
- Roussou, M., Oliver, M., & Slater, M. (2006). The virtual playground: an educational virtual reality environment for evaluating interactivity and conceptual learning. *Virtual Reality*, 10(3-4), 227-240. <https://doi.org/10.1007/s10055-006-0035-5>

- Rovira, A., Swapp, D., Spanlang, B., & Slater, M. (2009). The use of virtual reality in the study of people's responses to violent incidents. *Frontiers in Behavioral Neuroscience*, 3, 59. <https://doi.org/10.3389/neuro.08.059.2009>
- Rowe, A. D., Fitness, J. & Wood, L. N. (2015). University student and lecturer perceptions of positive emotions in learning. *International Journal of Qualitative Studies in Education*, 28(1), 1-20. <https://doi.org/10.1080/09518398.2013.847506>
- Rua, H., & Alvito, P. (2011). Living the past: 3D models, virtual reality and game engines as tools for supporting archaeology and the reconstruction of cultural heritage - the case-study of the Roman villa of Casal de Freiria. *Journal of Archaeological Science*, 38(12), 3296-3308. <https://doi.org/10.1016/j.jas.2011.07.015>
- Rueda, C., Godínes, J. & Rudman, P. (2018). Categorizing the educational affordances of 3 dimensional immersive digital environments. *Journal of Information Technology Education: Innovations in Practice*, 17(1), 83-112. <https://doi.org/10.28945/4056>
- Ruddle, R. A., Payne, S. J., & Jones, D. M. (1999). Navigating large-scale virtual environments: what differences occur between helmet-mounted and desktop displays? *Presence: Teleoperators & Virtual Environments*, 8(2), 157-168. <https://doi.org/10.1162/105474699566143>
- Ruddle, R. A., Volkova, E., & Bülthoff, H. H. (2011). Walking improves your cognitive map in environments that are large-scale and large in extent. *ACM Transactions on Computer-Human Interaction*, 18(2), 1-20. <https://doi.org/10.1145/1970378.1970384>
- Ruddle, R. A., Volkova, E., & Bülthoff, H. H. (2013). Learning to walk in virtual reality. *ACM Transactions on Applied Perception*, 10(2), 1-17. <https://doi.org/10.1145/2465780.2465785>
- Ruffaldi, E., Filippeschi, A., Avizzano, C. A., Bardy, B., Gopher, D., & Bergamasco, M. (2011). Feedback, affordances, and accelerators for training sports in virtual environments. *Presence: Teleoperators and Virtual Environments*, 20(1), 33-46. [https://doi.org/10.1162/pres\\_a\\_00034](https://doi.org/10.1162/pres_a_00034)
- Ruiter, M., Loyens, S., & Paas, F. (2015). Watch your step children! Learning two-digit numbers through mirror-based observation of self-initiated body movements. *Educational Psychology Review*, 27, 457-474. <https://doi.org/10.1007/s10648-015-9324-4>
- Rumrill, P., Fitzgerald, S., & Merchant, W. (2010). Using scoping literature reviews as a means of understanding and interpreting existing literature. *Work*, 35, 399-404. <https://doi.org/10.3233/WOR-2010-0998>

- Rupp, M. A., Kozachuk, J., Michaelis, J. R., Odette, K. L., Smither, J. A., & McConnell, D. S. (2016). The effects of immersiveness and future VR expectations on subjective-experiences during an educational 360 video. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (vol. 60, no. 1), 2108-2112. SAGE Publications.  
<https://doi.org/10.1177/1541931213601477>
- Rupp, M. A., Odette, K. L., Kozachuk, J., Michaelis, J. R., Smither, J. A., & McConnell, D. S. (2019). Investigating learning outcomes and subjective experiences in 360-degree videos. *Computers & Education*, 128, 256-268.  
<https://doi.org/10.1016/j.compedu.2018.09.015>
- Ruppert, B. (2011). New directions in the use of virtual reality for food shopping: marketing and education perspectives. *Journal of Diabetes Science and Technology*, 5, 315-318. <https://doi.org/10.1177/193229681100500217>
- Ryan, M. L. (2015). *Narrative as virtual reality 2: Revisiting immersion and interactivity in literature and electronic media*. John Hopkins University Press.
- Saettler, P. (2004). *The evolution of American educational technology*. IAP.
- Salamin, A. D. (2018). *Perception in VR 3D vs VR 360 video: How a key cognitive process in learning operates in virtual environments*. In J. Johnston (Ed.), *Proceedings of the EdMedia + Innovate Learning* (pp. 1565-1571). Association for the Advancement of Computing in Education (AACE).
- Salomon, G. (Ed.) (1993). *Distributed cognitions-psychological and educational considerations*. Cambridge University Press.
- Salzman, M. C., Dede, C., Loftin, R. B., & Chen, J. (1999). A model for understanding how virtual reality aids complex conceptual learning. *Presence: Teleoperators & Virtual Environments*, 8(3), 293-316.  
<https://doi.org/10.1162/105474699566242>
- Sanchez-Vives, M. V., Spanlang, B., Frisoli, A., Bergamasco, M., & Slater, M. (2010). Virtual hand illusion induced by visuomotor correlations. *PloS One*, 5(4), e10381. <https://doi.org/10.1371/journal.pone.0010381>
- Scapin, S., Echevarría-Guanilo, M. E., Boeira Fuculo Junior, P. R., Gonçalves, N., Rocha, P. K., & Coimbra, R. (2018). Virtual Reality in the treatment of burn patients: A systematic review. *Burns*, 44(6), 1403-1416.  
<https://doi.org/10.1016/j.burns.2017.11.002>
- Schafer, S. B. (Ed.) (2016). *Exploring the collective unconscious in the Age of Digital Media*. IGI Global. <https://doi.org/10.4018/978-1-4666-9891-8>
- Schnapp, B., & Warren, W. (2007). Wormholes in virtual reality: what spatial knowledge is learned for navigation? *Journal of Vision*, 7(9), 758-758.  
<https://doi.org/10.1167/7.9.758>
- Schneps, M. H., Ruel, J., Sonnert, G., Dussault, M., Griffin, M., & Sadler, P. M. (2014). Conceptualizing astronomical scale: Virtual simulations on handheld

- tablet computers reverse misconceptions. *Computers & Education*, 70, 269-280. <https://doi.org/10.1016/j.compedu.2013.09.001>
- Schönbrunner, O. (2000). *Human-computer interface in the CAVE*. <https://old.cescg.org/CESCG-2000/OSchoenbrunner/hci.html>
- Schubert, T., Friedmann, F., & Regenbrecht, H. (2001). The experience of presence: Factor analytic insights. *Presence: Teleoperators & Virtual Environments*, 10(3), 266-281. <https://doi.org/10.1162/105474601300343603>
- Schultze, U. (2010). Embodiment and presence in virtual worlds: A review. *Journal of Information Technology*, 25(4), 434-449. <https://doi.org/10.1057/jit.2010.25>
- Seasia Infotech, (n. d.) *Building digital experiences*. <https://www.seasiainfotech.com/blog/building-digital-experiences/>
- Seidel, R. J. & Rubin, M. (1977). *Computers and communications: Implications for education*. Academic Press.
- Seixas-Mikelus, S. A., Adal, A., Kesavadas, T., Baheti, A., Srimathveeravalli, G., Hussain, A., Chandrasekhar, R., Wilding, G. E., & Guru, K. A. (2010). Can image-based virtual reality help teach anatomy? *Journal of Endourology*, 24(4), 629-634. <https://doi.org/10.1089/end.2009.0556>
- Sekhar, C. C., Ch, S. S., & Rao, G. N. (2018). Future reality is immersive reality. *International Journal of Recent Technology and Engineering*, 7(4), 302-309.
- Selverian, M. M., & Hwang, H. S. (2003). In search of presence: A systematic evaluation of evolving VLEs. *Presence: Teleoperators & Virtual Environments*, 12(5), 512-522. <https://doi.org/10.1162/105474603322761306>
- Seth, A., Vance, J. M., & Oliver, J. H. (2011). Virtual reality for assembly methods prototyping: a review. *Virtual Reality*, 15(1), 5-20. <https://doi.org/10.1007/s10055-009-0153-y>
- Seymour, N. E., Gallagher, A. G., Roman, S. A., O'Brien, M. K., Bansal, V. K., Andersen, D. K., Satava, R. M. (2002). Virtual reality training improves operating room performance: results of a randomized, double-blinded study. *Annals of Surgery*, 236(4), 458-463. <https://doi.org/10.1097/00000658-200210000-00008>
- Shackelford, L., Huang, W. D., Craig, A., Merrill, C., Chen, D., & Arjona, J. (2018). A formative evaluation on a virtual reality game-based learning system for teaching introductory archaeology. *Proceedings of the E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education*, 605-611. Association for the Advancement of Computing in Education (AACE).
- Sharma, L., Jin, R., Prabhakaran, B., & Gans, M. (2018). LearnDNA: an interactive VR application for learning DNA structure. *Proceedings of the 3rd International Workshop on Interactive and Spatial Computing*, 80-87. ACM. <https://doi.org/10.1145/3191801.3191810>

- Sharma, S., Devreaux, P., Scribner, D., Grynovicki, J., & Grazaitis, P. (2017). Megacity: a collaborative virtual reality environment for emergency response, training, and decision making. *Electron. Imaging 2017*, 70-77.  
<https://www.doi.org/10.2352/ISSN.2470-1173.2017.1.VDA-390>
- Shaw, L. A., Wünsche, B. C., Lutteroth, C., Marks, S., & Callies, R. (2015). Challenges in virtual reality exergame design. *Proceedings of the 16<sup>th</sup> Australasian User Interface Conference (AUIC 2015)*, 61-68. Australian Computer Society Inc.
- Shaw, L. A., Wünsche, B., Lutteroth, C., Marks, S., Buckley, J., & Corballis, P. (2015). Development and evaluation of an exercycle game using immersive technologies. *Proceedings of the 8th Australasian Workshop on Health Informatics and Knowledge Management*, vol. 164.
- Sheikh, A., Brown, A., Watson, Z., & Evans, M. (2016). Directing attention in 360-degree video. *Proceedings of the IBC 2016 Conference*. IBC.  
<https://www.doi.org/10.1049/ibc.2016.0029>
- Sheridan, T. B. (1992). Musings on telepresence and virtual presence. *Presence: Teleoperators & Virtual Environments*, 1(1), 120-126.  
<https://doi.org/10.1162/pres.1992.1.1.120>
- Sheridan, T. B. (1996). Further musings on the psychophysics of presence. *Presence: Teleoperators & Virtual Environments*, 5(2), 241-246.  
<https://doi.org/10.1162/pres.1996.5.2.241>
- Sheridan, T. B. (2016). Recollections on presence beginnings, and some challenges for augmented and virtual reality. *Presence: Teleoperators and Virtual Environments*, 25(1), 75-77. [https://doi.org/10.1162/PRES\\_e\\_00247](https://doi.org/10.1162/PRES_e_00247)
- Sherman, B., & Judkins, P. (1992). Glimpses of heaven, visions of hell: Virtual reality and its implications. *Hodder & Stoughton*, 42-43.
- Sherman, W. R., & Craig, A.B., (2003). *Understanding Virtual Reality: Interface, application, and design*. Morgan Kaufmann Publishers.  
<https://doi.org/10.1162/105474603322391668>
- Shibata, T. (2002). Head mounted display. *Displays*, 23(1-2), 57-64.  
[https://doi.org/10.1016/S0141-9382\(02\)00010-0](https://doi.org/10.1016/S0141-9382(02)00010-0)
- Shu, Y., Huang, Y. Z., Chang, S. H., & Chen, M. Y. (2018). Do virtual reality head-mounted displays make a difference? A comparison of presence and self-efficacy between head-mounted displays and desktop computer-facilitated virtual environments. *Virtual Reality*, 23, 437-446.  
<https://doi.org/10.1007/s10055-018-0376-x>
- Shute, V., Ke, F., & Wang, L. (2017). Assessment and adaptation in games. In *Instructional techniques to facilitate learning and motivation of serious games*, 59-78. Springer. [https://doi.org/10.1007/978-3-319-39298-1\\_4](https://doi.org/10.1007/978-3-319-39298-1_4)

- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1), 3-10.
- Singh, S., Sedlack, R. E., & Cook, D. A. (2014). Effects of simulation-based training in gastrointestinal endoscopy: a systematic review and meta-analysis. *Clinical Gastroenterology and Hepatology*, 12(10), 1611-1623. <https://doi.org/10.1016/j.cgh.2014.01.037>
- Skulmowski, A., Pradel, S., Kühnert, T., Brunnett, G., & Rey, G. D. (2016). Embodied learning using a tangible user interface: The effects of haptic perception and selective pointing on a spatial learning task. *Computers & Education*, 92, 64-75. <https://doi.org/10.1016/j.compedu.2015.10.011>
- Skulmowski, A., & Rey, G. D. (2018). Embodied learning: introducing a taxonomy based on bodily engagement and task integration. *Cognitive Research: Principles and Implications*, 3, 6. <https://doi.org/10.1186/s41235-018-0092-9>
- Slater, M. (1999). Measuring presence: A response to the Witmer and Singer presence questionnaire. *Presence*, 8(5), 560-565. <https://doi.org/10.1162/105474699566477>
- Slater, M. (2002). Presence and the sixth sense. *Presence: Teleoperators and Virtual Environments*, 11(4), 435-439. <https://doi.org/10.1162/105474602760204327>
- Slater, M. (2009). Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1535), 3549-3557. <https://doi.org/10.1098/rstb.2009.0138>
- Slater, M., Antley, A., Davison, A., Swapp, D., Guger, C., Barker, C., Pistrang, N., & Sanchez-Vives, M. V. (2006). A virtual reprise of the Stanley Milgram obedience experiments. *PLoS One*, 1(1), e39. <https://doi.org/10.1371/journal.pone.0000039>
- Slater, M., Frisoli, A., Tecchia, F., Guger, C., Lotto, B., Steed, A., Pfurtscheller, G., Leeb, R., Reiner, M., Sanchez-Vives, M. V., Verschure, P., & Bernardet, U. (2007). Understanding and realizing presence in the Presencia project. *IEEE Computer Graphics and Applications*, 27(4), 90-93. <https://doi.org/10.1109/MCG.2007.93>
- Slater, M., Perez-Marcos, D., Ehrsson, H. H., & Sanchez-Vives, M. (2008). Towards a digital body: the virtual arm illusion. *Frontiers in Human Neuroscience*, 2, 6. <https://doi.org/10.3389/neuro.09.006.2008>
- Slater, M., Perez-Marcos, D., Ehrsson, H. H., & Sanchez-Vives, M. V. (2009). Inducing illusory ownership of a virtual body. *Frontiers in Neuroscience*, 3, 29. <https://doi.org/10.3389/neuro.01.029.2009>
- Slater, M., Rovira, A., Southern, R., Swapp, D., Zhang, J. J., Campbell, C., Levine, M. (2013). Bystander responses to a violent incident in an immersive virtual

- environment. *PloS One*, 8(1), e52766. <https://doi.org/10.1371/journal.pone.0052766>
- Slater, M., Sadagic, A., Usoh, M., & Schroeder, R. (2000). Small-group behavior in a virtual and real environment: a comparative study. *Presence: Teleoperators & Virtual Environments*, 9(1), 37-51. <https://doi.org/10.1162/105474600566600>
- Slater, M., & Sanchez-Vives, M. V. (2014). Transcending the self in immersive virtual reality. *Computer*, 47(7), 24-30. <https://doi.org/10.1109/MC.2014.198>
- Slater, M., Spanlang, B., Sanchez-Vives, M. V., & Blanke, O. (2010). First person experience of body transfer in virtual reality. *PloS One*, 5(5), e10564. <https://doi.org/10.1371/journal.pone.0010564>
- Slater, M., & Wilbur, S. (1997). A framework for immersive virtual environments (FIVE): Speculations on the role of presence in virtual environments. *Presence: Teleoperators & Virtual Environments*, 6(6), 603-616. <https://doi.org/10.1162/pres.1997.6.6.603>
- Slavin, R. E. (1980). Cooperative learning. *Review Of Educational Research*, 50(2), 315-342. <https://doi.org/10.3102/00346543050002315>
- Smutny, P., Babiuch, M., & Foltynnek, P. (2019). A review of the virtual reality applications in education and training. *Proceedings of the 2019 20th International Carpathian Control Conference, ICC 2019*. <https://doi.org/10.1109/CarpathianCC.2019.8765930>
- Snelson, C., & Hsu, Y. C. (2019). Educational 360-degree videos in virtual reality: A scoping review of the emerging research. *TechTrends*, 1-9. <https://doi.org/10.1007/s11528-019-00474-3>
- So, S., & Lu, E. (2019). Virtual reality in visual arts education: A study on using Google Tilt Brush. In J. Johnston (Ed.), *Proceedings of EdMedia + Innovate Learning* (pp. 1467-1472). Association for the Advancement of Computing in Education (AACE).
- Solina, F., Batagelj, B., & Glamočanin, S. (2008). Virtual skiing as an art installation. *Proceedings of the 50th International Symposium*, vol. 2, 507-510. IEEE.
- Song, H. S., Pusic, M., Nick, M. W., Sarpel, U., Plass, J. L., & Kalet, A. L. (2014). The cognitive impact of interactive design features for learning complex materials in medical education. *Computers & Education*, 71, 198-205. <https://doi.org/10.1016/j.compedu.2013.09.017>
- Song, S. H., & Song, E. J. (2019). A study on virtual training system for army thermal equipment maintenance education. *Proceedings of the Korean Institute of Information and Communication Sciences Conference*, 205-207. The Korea Institute of Information and Communication Engineering.

- Spiro, R. J., Feltovich, P. J., Feltovich, P. L., Jacobson, M. J., & Coulson, R. L. (1991). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. *Educational technology*, 31(5), 24-33.
- Sportillo, D., Paljic, A., & Ojeda, L. (2018). Get ready for automated driving using Virtual Reality. *Accident Analysis & Prevention*, 118, 102-113. <https://doi.org/10.1016/j.aap.2018.06.003>
- Staurset, E. M., & Prasolova-Førland, E. (2016). Creating a smart Virtual Reality simulator for sports training and education. *Proceedings of the Smart Education and e-Learning 2016*, 423-433. Springer. [https://doi.org/10.1007/978-3-319-39690-3\\_38](https://doi.org/10.1007/978-3-319-39690-3_38)
- Stepan, K., Zeiger, J., Hanchuk, S., Del Signore, A., Shrivastava, R., Govindaraj, S., & Illoreta, A. (2017). Immersive virtual reality as a teaching tool for neuroanatomy. *International Forum of Allergy & Rhinology*, 7(10), 1006-1013. <https://doi.org/10.1002/alr.21986>
- Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication*, 42(4), 73-93. <https://doi.org/10.1111/j.1460-2466.1992.tb00812.x>
- Stevens, J., Kincaid, P., & Sottolare, R. (2015). Visual modality research in virtual and mixed reality simulation. *The Journal of Defense Modeling and Simulation*, 12(4), 519-537. <https://doi.org/10.1177/1548512915569742>
- Spanlang, B., Navarro, X., Normand, J.-M., Kishore, S., Pizarro, R., & Slater, M. (2013). Real time whole body motion mapping for avatars and robots. *Proceedings of the 19th ACM Symposium on Virtual Reality Software and Technology-VRST'13*, 175-178. ACM. <https://doi.org/10.1145/2503713.2503747>
- Spanlang, B., Normand, J.-M., Borland, D., Kilteni, K., Giannopoulos, E., Pomes, A., González-Franco, M., Perez-Marcos, D., Arroyo-Palacios, J., Muncunill, X. N., & Slater, M. (2014). How to build an embodiment lab: achieving body representation illusions in virtual reality. *Frontiers in Robotics and AI*, 1, 9. <https://doi.org/10.3389/frobt.2014.00009>
- Stackpath (2019). *What is latency?* <https://blog.stackpath.com/latency/>
- Stark, L. W. (1995). How virtual reality works! The illusions of vision in real and virtual environments. In *Human vision, visual processing, and digital display VI*, 277-287. <https://doi.org/10.1117/12.207546>
- Steed, A., & Oliveira, M. F. (2009). *Networked graphics: Building networked games and virtual environments*. Elsevier.
- Steed, A., Spante, M., Heldal, I., Axelsson, A.-S., & Schroeder, R. (2003). Strangers and friends in caves: an exploratory study of collaboration in networked IPT systems for extended periods of time. *Proceedings of the 2003 Symposium on Interactive 3D Graphics*, 51-54. ACM. <https://doi.org/10.1145/641480.641492>



- Steptoe, W., Steed, A., Rovira, A., & Rae, J. (2010). Lie tracking: social presence, truth and deception in avatar-mediated telecommunication. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1039-1048. ACM. <https://doi.org/10.1145/1753326.1753481>
- Steptoe, W., Steed, A., & Slater, M. (2013). Human tails: ownership and control of extended humanoid avatars. *IEEE Transactions on Visualization and Computer Graphics*, 19(4), 583-590. <https://doi.org/10.1109/TVCG.2013.32>
- Steptoe, W., Wolff, R., Murgia, A., Guimaraes, E., Rae, J., Sharkey, P., Roberts, D., & Steed, A. (2008). Eye-tracking for avatar eye-gaze and interactional analysis in immersive collaborative virtual environments. *Proceedings of the 2008 ACM Conference on Computer Supported Cooperative Work*, 197-200. ACM. <https://doi.org/10.1145/1460563.1460593>
- Stoffregen, T. A., Hettinger, L. J., Haas, M. W., Roe, M. M., & Smart, L. J. (2000). Postural instability and motion sickness in a fixed-base flight simulator. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 42(3), 458-469. <https://doi.org/10.1518/001872000779698097>
- Stranger-Johannessen, E. (2018). Exploring math achievement through gamified virtual reality. *Proceedings of the European Conference on Technology Enhanced Learning*, 613-616. Springer. [https://doi.org/10.1007/978-3-319-98572-5\\_57](https://doi.org/10.1007/978-3-319-98572-5_57)
- Strasburger, H., & Pöppel, E. (2002). Visual field. *Encyclopedia of Neuroscience*, 2127-2129.
- Strasburger, H., Rentschler, I., & Jüttner, M. (2011). Peripheral vision and pattern recognition: A review. *Journal of Vision*, 11(5), 13-13. <https://doi.org/10.1167/11.5.13>
- Sun, Q., Mirhosseini, S., Gutenko, I., Park, J. H., Papadopoulos, C., Laha, B., & Kaufman, A. (2015). Buyers satisfaction in a virtual fitting room scenario based on realism of avatar. *Proceedings of the 3D User Interfaces (3DUI), 2015 IEEE Symposium*, 183-184. IEEE. <https://doi.org/10.1109/3DUI.2015.7131761>
- Sun, F. R., Pan, L. F., Wan, R. G., Li, H., & Wu, S. J. (2018). Detecting the effect of student engagement in an SVVR school-based course on higher level competence development in elementary schools by SEM. *Interactive Learning Environments*, 1-14. <https://doi.org/10.1007/s10984-017-9243-z>
- Sundar, S. S., Oh, J., Kang, H., & Sreenivasan, A. (2013). How does technology persuade? Theoretical mechanisms for persuasive technologies. In J. P. Dillard & L. Shen (Eds.), *The SAGE handbook of persuasion: Developments in theory and practice* (pp. 388-404). SAGE. <https://doi.org/10.4135/9781452218410.n23>

- Sundstedt, V., Chalmers, A., & Martinez, P. (2004). High fidelity reconstruction of the ancient Egyptian temple of Kalabsha. *Proceedings of the 3rd International Conference on Computer Graphics, Virtual Reality, Visualisation and Interaction in Africa*, 107-113. ACM.  
<https://doi.org/10.1145/1029949.1029970>
- SuperData (2020). *SuperData XR Q4 2019 Update*. <https://www.superdataresearch.com/blog/superdata-xr-update>
- Sutherland, I. E. (1968). A head-mounted three dimensional display. *Proceedings of the Fall Joint Computer Conference, Part I*, 33, 757-764. ACM.  
<https://doi.org/10.1145/1476589.1476686>
- Taiwo, R. (Ed.). (2010). *Handbook of research on discourse behavior and digital communication: Language structures and social interaction*. IGI Global.  
<https://doi.org/10.4018/978-1-61520-773-2>
- Takala, T., (2017). *CS-E4170 - Mobile Systems Programming*. University of South Australia.  
[https://mycourses.aalto.fi/pluginfile.php/548984/mod\\_resource/content/3/Aalto-Lecture4-Tracking.pptx.pdf](https://mycourses.aalto.fi/pluginfile.php/548984/mod_resource/content/3/Aalto-Lecture4-Tracking.pptx.pdf)
- Tam, M. (2000). Constructivism, instructional design, and technology: Implications for transforming distance learning. *Journal of Educational Technology & Society*, 3(2), 50-60.
- Tamaddon, K., & Stiefs, D. (2017). Embodied experiment of levitation in micro-gravity in a simulated virtual reality environment for science learning. *Proceedings of the IEEE Virtual Reality Workshop on K-12 Embodied Learning through Virtual & Augmented Reality (KELVAR)*, 1-5. IEEE.  
<https://doi.org/10.1109/KELVAR.2017.7961560>
- Tan, C. T., Leong, T. W., Shen, S., Dubravs, C., & Si, C. (2015). Exploring gameplay experiences on the oculus rift. *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play*, 253-263. ACM.  
<https://doi.org/10.1145/2793107.2793117>
- Taylor, G. S., & Barnett, J. S. (2013). Evaluation of wearable simulation interface for military training. *Human Factors*, 55(3), 672-690.  
<https://doi.org/10.1177/0018720812466892>
- Tecchia, F., Carrozzino, M., Bacinelli, S., Rossi, F., Vercelli, D., Marino, G., Gasparello, P., & Bergamasco, M. (2010). A flexible framework for wide-spectrum VR development. *Presence: Teleoperators and Virtual Environments*, 19(4), 302-312. [https://doi.org/10.1162/PRES\\_a\\_00002](https://doi.org/10.1162/PRES_a_00002)
- Teranishi, S., & Yamagishi, Y. (2018). Educational effects of a virtual reality simulation system for constructing self-built PCs. *Journal of Educational Multimedia and Hypermedia*, 27(3), 411-423.

- The Glossary of Education Reform (2013). *Learning experience*. [https://www.edglossary.org/learning-experience/?fbclid=IwAR1h8r4Lwp5\\_RD0v2ZOtKqyUOEgECyxETK2shvMValEi-WJcsMEJuc5HWVR4](https://www.edglossary.org/learning-experience/?fbclid=IwAR1h8r4Lwp5_RD0v2ZOtKqyUOEgECyxETK2shvMValEi-WJcsMEJuc5HWVR4)
- Thisgaard, M., & Makransky, G. (2017). Virtual learning simulations in high school: Effects on cognitive and non-cognitive outcomes and implications on the development of STEM academic and career choice. *Frontiers in Psychology*, 8(805), 1-13. <https://doi.org/10.3389/fpsyg.2017.00805>
- Thomson, J. J. (1976). Killing, letting die, and the trolley problem. *The Monist*, 59(2), 204-217. <https://doi.org/10.5840/monist197659224>
- Thompson, J. I. (2005). *A three dimensional helmet mounted primary flight reference for paratroopers*. Thesis for Air Force Institute of Technology.
- Thompson-Butel, A. G., Shiner, C. T., McGhee, J., Bailey, B. J., Bou-Haidar, P., McCorriston, M., & Faux, S. G. (2019). The role of personalized virtual reality in education for patients post stroke-A qualitative case series. *Journal of Stroke and Cerebrovascular Diseases*, 28(2), 450-457. <https://doi.org/10.1016/j.jstrokecerebrovasdis.2018.10.018>
- Tiainen, T., Ellman, A., & Kaapu, T. (2014). Virtual prototypes reveal more development ideas: comparison between customers' evaluation of virtual and physical prototypes. *Virtual and Physical Prototyping*, 9(3), 169-180. <https://doi.org/10.1080/17452759.2014.934573>
- Tokel, S. T., & Isler, V. (2015). Acceptance of virtual worlds as learning space. *Innovations in Education and Teaching International*, 52(3), 254-264. <https://doi.org/10.1080/14703297.2013.820139>
- Tamaddon, K., & Stiefs, D. (2017). Embodied experiment of levitation in micro-gravity in a simulated virtual reality environment for science learning. *Proceedings of the EEE Virtual Reality Workshop on K-12 Embodied Learning through Virtual & Augmented Reality (KELVAR)*, 1-5. IEEE. <https://doi.org/10.1109/KELVAR.2017.7961560>
- Tolhurst, D. (1992). A checklist for evaluating content-based hypertext computer software. *Educational Technology*, 32(3), 17-21.
- Tom's Hardware (2018). *VR lens basics: Present and future*. <https://www.tomshardware.com/news/virtual-reality-lens-basics-vr,36182.html>
- Topu, F. B., & Goktas, Y. (2019). The effects of guided-unguided learning in 3d virtual environment on students' engagement and achievement. *Computers in Human Behavior*, 92, 1-10. <https://doi.org/10.1016/j.chb.2018.10.022>
- Tran, C., Smith, B., & Buschkuehl, M. (2017). Support of mathematical thinking through embodied cognition: Nondigital and digital approaches. *Cognitive*

- Research: Principles and Implications*, 2, 16. <https://doi.org/10.1186/s41235-017-0053-8>
- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K., Colquhoun, H., Kastner, M., Levac, D., Ng, C., Sharpe, J. P., Wilson, K., Kenny, M., Warren, R., Wilson, C., Stelfox, H. T., & Straus, S. E. (2016). A scoping review on the conduct and reporting of scoping reviews. *BMC Medical Research Methodology*, 16(1), 15. <https://doi.org/10.1186/s12874-016-0116-4>
- Trindade, J., Fiolhais, C., & Almeida, L. (2002). Science learning in virtual environments: a descriptive study. *British Journal of Educational Technology*, 33(4), 471-488. <https://doi.org/10.1111/1467-8535.00283>
- Tromp, J., Bullock, A., Steed, A., Sadagic, A., Slater, M., & Frecon, E. (1998). Small group behavior experiments in the Coven project. *IEEE Computer Graphics and Applications*, 18(6), 53-63. <https://doi.org/10.1109/38.734980>
- Upload VR (2017). *What's next for VR audio*. <https://uploadvr.com/world-vr-audio-perspective/>
- Van Broekhuizen, L. (2016). *The paradox of classroom technology: Despite proliferation and access, students not using technology for learning*. *AdvancED research*. AdvancED.
- Van der Hoort, B., Guterstam, A., & Ehrsson, H. H. (2011). Being Barbie: the size of one's own body determines the perceived size of the world. *PLoS One*, 6(5), e20195. <https://doi.org/10.1371/journal.pone.0020195>
- Vacharkulksemsuk, T. & Fredrickson, B. L. (2013). Looking back and glimpsing forward: The Broaden-and-Build Theory of Positive Emotions as applied to organizations. *Advances in Positive Organizational Psychology*, 1, 45-60.
- Vaughan, N., Dubey, V. N., Wainwright, T. W., & Middleton, R. G. (2016). A review of virtual reality based training simulators for orthopaedic surgery. *Medical Engineering & Physics*, 38(2), 59-71. <https://doi.org/10.1016/j.medengphy.2015.11.021>
- Vignais, N., Bideau, B., Craig, C., Brault, S., Multon, F., & Kulpa, R. (2009). Virtual environments for sport analysis: perception-action coupling in handball goal-keeping. *International Journal of Virtual Reality*, 8(4), 43-48. <https://doi.org/10.20870/IJVR.2009.8.4.2748>
- Virtual Reality Society (n. d.). History of Virtual Reality. <https://www.vrs.org.uk/virtual-reality/history.html>
- Virtual Reality Times (2020). *Top 5 haptic VR devices Set to launch in 2020*. <https://virtualrealitytimes.com/2020/02/23/top-5-haptic-vr-devices-set-to-launch-in-2020/>
- Vrscout (2019). *Hands-on: Oculus Quest hand tracking feels great, but it's not perfect*. <https://vrscout.com/news/hands-on-oculus-quest-hand-tracking/>

- Wang, Z., Giannopoulos, E., Slater, M., Peer, A., & Buss, M. (2011). Handshake: realistic human-robot interaction in haptic enhanced virtual reality. *Presence: Teleoperators and Virtual Environments*, 20(4), 371-392. [https://doi.org/10.1162/PRES\\_a\\_00061](https://doi.org/10.1162/PRES_a_00061)
- Warburton, E. C., Wilson, M., Lynch, M., & Cuykendall, S. (2013). The cognitive benefits of movement reduction: Evidence from dance marking. *Psychological Science*, 24, 1732-1739. <https://doi.org/10.1177/0956797613478824>
- Webel, S., Olbrich, M., Franke, T., & Keil, J. (2013). Immersive experience of current and ancient reconstructed cultural attractions. *Proceedings of the Digital Heritage International Congress (DigitalHeritage)*, 2013, 395-398. IEEE. <https://doi.org/10.1109/DigitalHeritage.2013.6743766>
- Webster, R. (2016). Declarative knowledge acquisition in immersive virtual learning environments. *Interactive Learning Environments*, 24(6), 1319-1333. <https://doi.org/10.1080/10494820.2014.994533>
- Webster, R., & Dues Jr, J. F. (2017). System Usability Scale (SUS): Oculus Rift® DK2 and Samsung Gear VR®. *Proceedings of the 2017 ASEE Annual Conference & Exposition*, 1-12. ASSE.
- Weissberg, R. P., Durlak, J. A., Domitrovich, C. E., & Gullotta, T. P. (2015). Social and emotional learning: Past, present, and future. In J. A. Durlak, C. E. Domitrovich, R. P. Weissberg, & T. P. Gullotta (Eds.), *Handbook of social and emotional learning: Research and practice* (pp. 3-19). The Guilford Press.
- Wellner, M., Sigrist, R., Von Zitzewitz, J., Wolf, P., & Riener, R. (2010). Does a virtual audience influence rowing. *Journal of Sports Engineering and Technology*, 224(1), 117-128. <https://doi.org/10.1243/17543371JSET33>
- Wheatstone, C. (1838). Contributions to the physiology of vision-Part the first. On some remarkable, and hitherto unobserved phenomena of binocular vision. In surname missing, initials missing (Eds.) 1838, *no title given*.
- Wheeler, A. (2016). *Understanding virtual reality headsets*. Engineering.com.
- Wilcox, L. M., Allison, R. S., Elfassy, S., & Grelik, C. (2006). Personal space in virtual reality. *ACM Transactions on Applied Perception (TAP)*, 3(4), 412-428. <https://doi.org/10.1145/1190036.1190041>
- Wilson, R. A., & Foglia, L. (2011). Embodied cognition. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy*. Stanford University.
- Winn, W. (1993). *A conceptual basis for educational applications of virtual reality*. Technical Publication R-93-9. Human Interface Technology Laboratory of the Washington Technology Center, University of Washington.
- Wirth, W., Hartmann, T., Böcking, S., Vorderer, P., Klimmt, C., Schramm, H., Saari, T., Laarni, J., Ravaja, N., Gouveia, F. R., Biocca, F., Sacau, A., Jänck, L., Baumgartner, T., & Jäncke, P. (2007). A process model of the formation of spatial presence experiences. *Media Psychology*, 9(3), 493-525. <https://doi.org/10.1080/15213260701283079>

- Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence*, 7(3), 225-240.  
<https://doi.org/10.1162/105474698565686>
- World Travel and Tourism Council. (2015). *Travel and tourism - Economic impact 2015 - World*. <https://wttc.org/Research/Economic-Impact>
- Worrall, M., & Hutchinson, D. (2014). Exploring a model for training simulations. *Proceeding of the Asian-Pacific Simulation Training Conference and Exhibition (SimTecT 2014)*, 173-176.
- Wright, P., McCarthy, J., & Meekison, L. (2004). Making sense of experience. In M. Blythe, C. Overbeeke, A. F. Monk, & P. C. Wright (Eds.), *Funology: From usability to enjoyment* (pp. 43-53). Kluwer. [https://doi.org/10.1007/1-4020-2967-5\\_5](https://doi.org/10.1007/1-4020-2967-5_5)
- Wu, B., Yu, X., & Gu, X. (2020). Effectiveness of immersive virtual reality using head-mounted displays on learning performance: A meta-analysis. *British Journal of Educational Technology*, 51(6), 1991-2005.  
<https://doi.org/10.1111/bjet.13023>
- Xu, D., & Jaggars, S. (2011). *Online and hybrid course enrollment and performance in Washington State community and technical colleges*.  
<https://pdfs.semanticscholar.org/69e9/36fbd521711c812dfe2b63723bb71268813d.pdf>
- Yassien, A., El Agroudy, P., Makled, E., & Abdennadher, S. (2020). A Design space for social presence in VR. *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society*, 1-12.  
<https://doi.org/10.1145/3419249.3420112>
- Yee, N., & Bailenson, J. N. (2007). The Proteus effect: the effect of transformed self-representation on behavior. *Human Communication Research*, 33(3), 271-290. <https://doi.org/10.1111/j.1468-2958.2007.00299.x>
- Yousef, A., M., F., Chatti, M., A., Schroeder, U., Wosnitza, M. & Jakobs, H. (2014). MOOCs: A review of the state-of-the-art. *Proceedings of the CSEDU 2014, 6th International Conference on Computer Supported Education*, 9-20.
- Yun, H., Park, S., & Ryu, J. (2019). Exploring the influences of immersive virtual reality pre-service teacher training simulations on teacher efficacy. *Proceedings of the Society for Information Technology & Teacher Education International Conference*, 1858-1862. Association for the Advancement of Computing in Education (AACE).
- Zaho, Z. X. (2002). Virtual reality technology: an overview. *Journal of Southeast University*, 32(2), 1-10.
- Zendejas, B., Brydges, R., Hamstra, S. J., & Cook, D. A. (2013). State of the evidence on simulation-based training for laparoscopic surgery: a systematic review. *Annals of Surgery*, 257(4), 586-593.  
<https://doi.org/10.1097/SLA.0b013e318288c40b>

- Zhang, K., Suo, J., Chen, J., Liu, X., & Gao, L. (2017). Design and implementation of fire safety education system on campus based on virtual reality technology. *Proceedings of the 2017 Federated Conference on Computer Science and Information Systems (FedCSIS)*, 1297-1300. IEEE.  
<https://doi.org/10.15439/2017F376>
- Zhao, S. (2003). Toward a taxonomy of copresence. *Presence: Teleoperators and Virtual Environments*, 12(5), 445-455.  
<https://doi.org/10.1162/105474603322761261>
- Zhou, N. N., & Deng, Y. L. (2009). Virtual reality: A state-of-the-art survey. *International Journal of Automation and Computing*, 6(4), 319-325.  
<https://doi.org/10.1007/s11633-009-0319-9>
- Zhou, Y., Ji, S., Xu, T., & Wang, Z. (2018). Promoting knowledge construction: A model for using virtual reality interaction to enhance learning. *Procedia Computer Science*, 130, 239-246. <https://doi.org/10.1016/j.procs.2018.04.035>
- Zikky, M., Fathoni, K., & Firdaus, M. (2018). Interactive distance media learning collaborative based on virtual reality with solar system subject. *Proceedings of the 2018 19th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD)*, 4-9. IEEE. <https://doi.org/10.1109/SNPD.2018.8441031>

## ***Παράρτημα***





Κατάλογος άρθρων που χρησιμοποιήθηκαν για τον προσδιορισμό των παραγόντων που επηρεάζουν την ΠΕΨΜΕ

- Abeele, V. V., Spiel, K., Nacke, L., Johnson, D., & Gerling, K. (2019). Development and validation of the player experience inventory: A scale to measure player experiences at the level of functional and psychosocial consequences. *International Journal of Human-Computer Studies*, *135*, 102370. <https://doi.org/10.1016/j.ijhcs.2019.102370>
- Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *MIS Quarterly*, *24*(4), 665-694. <https://doi.org/10.2307/3250951>
- Baños, R. M., Botella, C., Garcia-Palacios, A., Villa, H., Perpiña, C., & Alcañiz, M. (2000). Presence and reality judgment in virtual environments: A unitary construct? *CyberPsychology & Behavior*, *3*(3), 327-335. <https://doi.org/10.1089/10949310050078760>
- Bernhaupt, R., & Pirker, M. (2013). Evaluating user experience for interactive television: towards the development of a domain-specific user experience questionnaire. *Proceedings of the IFIP Conference on Human-Computer Interaction*, 642-659. Springer. [https://doi.org/10.1007/978-3-642-40480-1\\_45](https://doi.org/10.1007/978-3-642-40480-1_45)
- Boletsis, C. (2020). A user experience questionnaire for VR locomotion: Formulation and preliminary evaluation. *Proceedings of the International Conference on Augmented Reality, Virtual Reality and Computer Graphics*, 157-167. Springer. [https://doi.org/10.1007/978-3-030-58465-8\\_11](https://doi.org/10.1007/978-3-030-58465-8_11)
- Brockmyer, J. H., Fox, C. M., Curtiss, K. A., McBroom, E., Burkhart, K. M., & Pidruzny, J. N. (2009). The development of the Game Engagement Questionnaire: A measure of engagement in video game-playing. *Journal of Experimental Social Psychology*, *45*(4), 624-634. <https://doi.org/10.1016/j.jesp.2009.02.016>
- Brooke, J. (1996). SUS: a "quick and dirty" usability. In P. W. Jordan, B. Thomas, B. A. Weerdeester, & I. L. McClelland (Eds.), *Usability evaluation in industry* (pp. 189-193). Taylor & Francis.
- Calvillo-Gámez, E. H., Cairns, P., & Cox, A. L. (2015). Assessing the core elements of the gaming experience. In R. Bernhaupt (Ed.), *Game user experience evaluation* (pp. 37-62). Springer. <https://doi.org/10.1007/978-3-319-15985-0>
- Cassidy, S., & Eachus, P. (2002). Developing the computer user self-efficacy (CUSE) scale: Investigating the relationship between computer self-efficacy, gender and experience with computers. *Journal of Educational Computing Research*, *26*(2), 133-153. <https://doi.org/10.2190/JGJR-OKVL-HRF7-GCNV>

- Chen, M., Kolko, B. E., Cuddihy, E., & Medina, E. (2011). Modeling but NOT measuring engagement in computer games. In C. Steinkuehler, C. Martin, & A. Ochsner (Eds.), *Proceedings of the 7th International Conference on Games+ Learning+ Society Conference* (pp. 55-63). ETC Press.
- Choi, D., & Kim, J. (2004). Why people continue to play online games: In search of critical design factors to increase customer loyalty to online contents. *CyberPsychology & Behavior*, 7(1), 11-24.  
<https://doi.org/10.1089/109493104322820066>
- Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology*, 10, 85-102.
- De Kort, Y. A., IJsselsteijn, W. A., & Poels, K. (2007). Digital games as social presence technology: Development of the Social Presence in Gaming Questionnaire (SPGQ). *Proceedings of PRESENCE*, 195203, 1-9.
- Fang, X., Zhang, J., & Chan, S. S. (2013). Development of an instrument for studying flow in computer game play. *International Journal of Human-Computer Interaction*, 29(7), 456-470. <https://doi.org/10.1080/10447318.2012.715991>
- Fu, F. L., Su, R. C., & Yu, S. C. (2009). EGameFlow: A scale to measure learners' enjoyment of e-learning games. *Computers & Education*, 52(1), 101-112. <https://doi.org/10.1016/j.compedu.2008.07.004>
- Gunawardena, C. N., & Zittle, F. J. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *American Journal of Distance Education*, 11(3), 8-26.  
<https://doi.org/10.1080/08923649709526970>
- Hartmann, T., Wirth, W., Schramm, H., Klimmt, C., Vorderer, P., Gysbers, A., Böcking, S., Ravaja, N., Laarni, J., Saari, T., Gouveia, F., & Sacau, A. M. (2015). The spatial presence experience scale (SPES). *Journal of Media Psychology*, 28, 1-15. <https://doi.org/10.1027/1864-1105/a000137>
- Hartung, F., Burke, M., Hagoort, P., & Willems, R. M. (2016). Taking perspective: Personal pronouns affect experiential aspects of literary reading. *PLoS One*, 11(6), 1-18, e0157285. <https://doi.org/10.1371/journal.pone.0157285>
- Hassenzahl, M., Burmester, M., & Koller, F., (2003). AttracDiff: Ein Fragebogen zur messung wahrgenommener hedonischer und pragmatischer Qualität [AttracDiff: A questionnaire to measure perceived hedonic and pragmatic quality]. In J. Ziegler & G. Szwillus (Eds.), *Mensch & Computer 2003* (pp. 187-196). Vieweg+Teubner Verlag. [https://doi.org/10.1007/978-3-322-80058-9\\_19](https://doi.org/10.1007/978-3-322-80058-9_19)
- Hinderks, A., Schrepp, M., Mayo, F. J. D., Escalona, M. J., & Thomaschewski, J. (2019). Developing a UX KPI based on the user experience questionnaire. *Computer Standards & Interfaces*, 65, 38-44.  
<https://doi.org/10.1016/j.csi.2019.01.007>

- Högberg, J., Hamari, J., & Wästlund, E. (2019). Gameful Experience Questionnaire (GAMEFULQUEST): an instrument for measuring the perceived gamefulness of system use. *User Modeling and User-Adapted Interaction*, 29(3), 619-660. <https://doi.org/10.1007/s11257-019-09223-w>
- Ibili, E., & Billinghamurst, M. (2019). Assessing the relationship between cognitive load and the usability of a mobile augmented reality tutorial system: A study of gender effects. *International Journal of Assessment Tools in Education*, 6(3), 378-395. <https://doi.org/10.21449/ijate.594749>
- IJsselsteijn, W. A., de Kort, Y. A., & Poels, K. (2013). The game experience questionnaire. *Eindhoven: Technische Universiteit Eindhoven*, 46(1), 3-9.
- Jackson, S. A., & Marsh, H. W. (1996). Development and validation of a scale to measure optimal experience: The Flow State Scale. *Journal of Sport and Exercise Psychology*, 18(1), 17-35. <https://doi.org/10.1123/jsep.18.1.17>
- Jennett, C., Cox, A. L., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., & Walton, A. (2008). Measuring and defining the experience of immersion in games. *International Journal of Human-Computer Studies*, 66(9), 641-661. <https://doi.org/10.1016/j.ijhcs.2008.04.004>
- Keller, J. M. (2006). *Development of two measures of learner motivation: CIS and IMMS*. Florida State University. <https://studylib.net/doc/7446614/development-of-two-measures-of-learner-motivation>
- Kennedy, R. S., Lane, N. E., Berbaum, K. S., & Lilienthal, M. G. (1993). Simulator sickness questionnaire: An enhanced method for quantifying simulator sickness. *The international Journal of Aviation Psychology*, 3(3), 203-220. [https://doi.org/10.1207/s15327108ijap0303\\_3](https://doi.org/10.1207/s15327108ijap0303_3)
- Kim, H. K., Park, J., Choi, Y., & Choe, M. (2018). Virtual reality sickness questionnaire (VRSQ): Motion sickness measurement index in a virtual reality environment. *Applied Ergonomics*, 69, 66-73. <https://doi.org/10.1016/j.apergo.2017.12.016>
- Laugwitz, B., Held, T., & Schrepp, M. (2008). Construction and evaluation of a user experience questionnaire. In A. Holzinger (Ed.), *HCI and usability for education and work, USAB 2008. Lecture Notes in Computer Science* (vol. 5298, pp. 63-76). Springer. [https://doi.org/10.1007/978-3-540-89350-9\\_6](https://doi.org/10.1007/978-3-540-89350-9_6)
- Lin, J. J. W., Duh, H. B. L., Parker, D. E., Abi-Rached, H., & Furness, T. A. (2002). Effects of field of view on presence, enjoyment, memory, and simulator sickness in a virtual environment. *Proceedings IEEE Virtual Reality 2002*, 164-171. IEEE. <https://doi.org/10.1109/VR.2002.996519>
- Makransky, G., Lilleholt, L., & Aaby, A. (2017). Development and validation of the Multimodal Presence Scale for virtual reality environments: A confirmatory factor analysis and item response theory approach. *Computers in Human Behavior*, 72, 276-285. <https://doi.org/10.1016/j.chb.2017.02.066>

- Minge, M., Thüring, M., & Wagner, I. (2016). Developing and validating an English version of the meCUE questionnaire for measuring user experience. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, vol. 60, no. 1, 2063-2067. SAGE Publications.  
<https://doi.org/10.1177/1541931213601468>
- Murphy, C. A., Coover, D., & Owen, S. V. (1989). Development and validation of the computer self-efficacy scale. *Educational and Psychological measurement*, 49(4), 893-899. <https://doi.org/10.1177/001316448904900412>
- Nijs, L., Coussement, P., Moens, B., Amelinck, D., Lesaffre, M., & Leman, M. (2012). Interacting with the Music Paint Machine: Relating the constructs of flow experience and presence. *Interacting with Computers*, 24(4), 237-250. <https://doi.org/10.1016/j.intcom.2012.05.002>
- Parnell, M. J., Berthouze, N., & Brumby, D. (2009). *Playing with scales: Creating a measurement scale to assess the experience of video games* [Unpublished master's thesis]. University College London.
- Pavlas, D., Jentsch, F., Salas, E., Fiore, S. M., & Sims, V. (2012). The play experience scale: development and validation of a measure of play. *Human factors*, 54(2), 214-225. <https://doi.org/10.1177/0018720811434513>
- Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P., 2011. Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology*, 36(1), 36-48. <https://doi.org/10.1016/j.cedpsych.2010.10.002>
- Phan, M. H., Keebler, J. R., & Chaparro, B. S. (2016). The development and validation of the game user experience satisfaction scale (GUESS). *Human Factors*, 58(8), 1217-1247. <https://doi.org/10.1177/0018720816669646>
- Qin, H., Patrick Rau, P. L., & Salvendy, G. (2009). Measuring player immersion in the computer game narrative. *International Journal of Human-Computer Interaction*, 25(2), 107-133. <https://doi.org/10.1080/10447310802546732>
- Ratan, R. A., & Hasler, B. (2009). Self-presence standardized: Introducing the self-presence questionnaire (SPQ). *Proceedings of the 12th Annual International Workshop on Presence*, vol. 81, 1-8. University of Southern California.
- Rheinberg, F., Vollmeyer, R., & Engeser, S. (2003). Die erfassung des flow-erlebens [Capturing the flow experience]. In J. Stiensmeier-Pelster & F. Rheinberg (Eds.), *Diagnostik von motivation und selstkonzept* (tests und trends) (pp. 261-279). Hogrefe.
- Rigby, J. M., Brumby, D. P., Gould, S. J. J., & Cox, A. L. (2019). Development of a questionnaire to measure immersion in video media. *Proceedings of the*

- 2019 ACM International Conference on Interactive Experiences for TV and Online Video, 35-46. ACM. <https://doi.org/10.1145/3317697.3323361>
- Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and emotion, 30*(4), 344-360. <https://doi.org/10.1007/s11031-006-9051-8>
- Sauro, J., & Zarolia, P. (2017). SUPR-Qm: a questionnaire to measure the mobile app user experience. *Journal of Usability Studies, 13*(1), 17-37.
- Schrepp, M., Hinderks, A., & Thomaschewski, J. (2014). Applying the user experience questionnaire (UEQ) in different evaluation scenarios. In A. Marcus (Ed.), *Proceedings of the International Conference of Design, User Experience, and Usability* (pp. 383-392). Springer. [https://doi.org/10.1007/978-3-319-07668-3\\_37](https://doi.org/10.1007/978-3-319-07668-3_37)
- Schrepp, M., Hinderks, A., & Thomaschewski, J. (2017). Design and evaluation of a short version of the user experience questionnaire (UEQ-S). *International Journal of Interactive Multimedia and Artificial Intelligence, 4*(6), 103-108. <https://doi.org/10.9781/ijimai.2017.09.001>
- Schubert, T., Friedmann, F., & Regenbrecht, H. (2001). The experience of presence: Factor analytic insights. *Presence: Teleoperators and Virtual Environments, 10*(3), 266-281. <https://doi.org/10.1162/105474601300343603>
- Slater, M. (1999). Measuring presence: A response to the Witmer and Singer presence questionnaire. *Presence, 8*(5), 560-565. <https://doi.org/10.1162/105474699566477>
- Slater, M., Usoh, M., & Steed, A. (1994). Depth of presence in virtual environments. *Presence: Teleoperators & Virtual Environments, 3*(2), 130-144. <https://doi.org/10.1162/pres.1994.3.2.130>
- Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *STAI. Manual for the State-Trait Anxiety Inventory (self-evaluation questionnaire)*. Consulting Psychologist Press, 1-24.
- Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*(10), 1092-1097. <https://doi.org/10.1001/archinte.166.10.1092>
- Vorderer, P., Wirth, W., Gouveia, F., Biocca, F., Saari, T., & Jiancke, F. (2004). *MEC spatial presence questionnaire (MEC-SPQ): Short documentation and instructions for application*. Report to the European Community, Project Presence.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063-1070. <https://doi.org/10.1037/0022-3514.54.6.1063>

Wiebe, E. N., Lamb, A., Hardy, M., & Sharek, D. (2014). Measuring engagement in video game-based environments: Investigation of the User Engagement Scale. *Computers in Human Behavior*, 32, 123-132.

<https://doi.org/10.1016/j.chb.2013.12.001>

Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence*, 7(3), 225-240.

<https://doi.org/10.1162/105474698565686>