Table 2. Description of Studies Included in Systematic Review

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| Author, Year | Design/  Quality Score | | Course | Duration | Description of Intervention |
| Belfi, et al., 2015 | Mixed method\*  1+1+0+1+1=4 | | Medicine | 12 hrs over 3 days  Divided subject matter taught (blended, independent, lecture) to the same group of students | **Experimental:** pre-class e-learning modules uploaded to website. Interactive lecture with a case-based approach, games, open-ended questioning.  **Control:** 50 minlecture |
| Bösner, et al.,  2015 | Mixed method\*  0+1+0+1+1=3 | | Medicine | 14 course sessions in 1 semester | **Experimental:**  E-learning modules -videos and audio lectures available for pre- class preparation. 42 hrs of face-to-face teaching, 3 hrs/wk in interactive skills lab including simulation, small group work and quiz exercises  **Control:** not described |
| Boysen-Osborn et al., 2016 | Quasi-experimental  1+1+0+1+1=4 | | ACLS Medicine | 27.5 hours | **Experimental:** 27.5 hours of flipped class; podcasts (preparation for class), small group simulation as class activity (team-based learning)  **Control:** 20 hours of traditional lecture class (8 lecture and class demonstration) |
| Evans et al., 2016 | Quasi-experimental  1+1+0+1+1=4 | | Medicine | 7 weeks/course | **Experimental**: lecture format / 11.25 in class  **Control:** Self-paced modules with video and quiz / small group in-class case based discussion / 4.3 hours in class and 6 hours on line |
| Everly, 2013 | Mixed method\*  1+3+0+1+1=6 | | Undergrad Nursing, Maternity/ newborn | 1 semester each for Control and Test groups and replicated 1 additional semester- different group of students each semester | **Experimental:** pre-class preparation: pre-recorded lectures and text review. In-class time: quiz, small group activities  **Control:** lecture methods not described |
| Ferreri & O’Connor, 2013 | Descriptive, retrospective  1+2+0+1+1=5 | | Graduate level Pharmacy | 1 semester course compared over 2 yrs | **Experimental:** required reading for class preparation Small group case-based activities in class. 80 min session 2x/wk  **Control:** 2-hr session once wk |
| Galway et al., 2014 | Mixed method\*  0+1+0+1+1=3 | | Master’s in Public Health | One semester scores from Experimental: 2013  Control: 2011 | **Experimental:**NextGenU.org course including online peer activities, discussion forums, quizzes and learning resources. In-class session every 2 wks included mini-lesson, Q&A, active learning activities  **Control:** not described |
| Geist et al., 2015 | Quasi-experimental  1+1+0+1+0=3 | | Undergrad Nursing | Experimental: Spring 2013  Control: Fall 2012 | **Experimental:** flipped  **Control:** lecture |
| Gillispie, 2016 | Quasi-experimental (retrospective comparisons)  1+1+0+1+1=4 | | Medicine: Ob/gyn clerkship | 4 rotation blocks (8 weeks) | **Experimental:** compared rotation blocks 2-3 / voice over presentations of lectures/recorded and made available to students (2015) and problem based learning sessions in class  **Control:** lecture / traditional class |
| Harrington et al.,  2015 | RCT  1+2+1+1+0=5 | | Undergrad Nursing | 14 wks (1 semester) | **Experimental:**  Pre-class preparation via  online course site  **Control:** live lectures with minimal classroom activities |
| Heitz et al., 2015 | Experimental  1+1+1+1+1=5 | | Medicine | 4 weeks | **Experimental:** Asynchronous online modules, no class, asked to choose patients that represented chief complaint being studied  **Control:** standard didactic |
| Kiviniemi, 2014 | Quasi-experimental  non-equivalent control group  1+2+0+1+1=5 | | Chiropractic health | 3 3½ hr units; 1 semester each  Control: Fall 2011  Experimental: Fall 2012 | **Experimental:** Pre-recorded lecture content and 80% in-class time for active learning  **Control:** Traditional format- reading assignments, lecture, small group work, class discussions (40% class time for active learning) |
| Koo et al., 2016 | Quasi-experimental  1+2+0+1+1=5 | | Pharmacy | Fall 2011-2012 (one semester/8 sessions) | **Experimental:** on-line component replaced 30-60% of traditional delivery with prerecorded videos and self-assessment questions: biweekly class time was spent in application activities through use of case studies  **Control:** control / non-randomized / comparison / traditional lecture |
| Liebert et al., 2016 | Quasi-experimental  1+3+0+1+1=6 | | Medicine | 8 week rotations | **Experimental:** 8 one week modules with implementation of interactive class sessions (pre-test review, case-based clinical reasoning, simulation based surgical skills)  **Control:** traditional lecture based |
| Marshall et al., 2014 | Quasi-experimental, comparative  1+1+0+1+1=4 | | Pharmacy | 1 semester each. Modules: Year 1 – flipped (osteoarthritis) and traditional (gout). Year 2 – flipped (gout) and traditional (osteoarthritis). Taught by 5 faculty with 3½ 50 min class periods/topic. | **Experimental:** Pre-class readings, powerpoints, abbreviated lecture format, 70% class time on guided discussions of mini-cases, graded case questions, 30% time on lecture  **Control:** 70% of class time for lecture, 30% for class discussion |
| Mattis, 2014 | Quasi-experimental  1+1+1+1+1=5 | | Nursing | 1 hour | **Experimental:** video recording preparation prior to class, in-class application  **Control:** visual only instruction |
| McLaughlin et al., 2014 | | Mixed-method\*  1+1+0+1+1=4 | Graduate Pharmacy | One semester (13 wks - 25 classes), 2x/wk 75 min in class session  Experimental: 2012  Control: 2011  Same final cumulative exam | **Experimental:** 21-55 min prerecorded online lectures, in-class: 4 active-learning exercises, (audience response/ questions, pair & share, student presentations, microlectures), quizzes  **Control:** 60-75 min lecture, occasional 15 min for quiz or pair & share, no quizzes |
| Missildine et al.,  2013 | Quasi- experimental  1+1+0+1+1=4 | | Undergrad Nursing | 1 semester each over 3 consecutive semesters  Experimental: LCI Fall 2010  Control: LO Fall 2009, LLC: Spring 2010 | **Experimental:** recorded lecture capture with interactive activities (LCI) during classroom time, all faculty used same 4 active learning activities  **Control:** classroom lecture only (LO) and classroom lecture plus capture backup (LLC) |
| Morton & Colbert-Getz, 2016 | Quasi-experimental  1+1+0+1+1=4 | | Medicine | Anatomy content  17 wk courses | **Experimental:** video tutorials (5-12 min/each), workbook discussion classroom – think, pair, share, large group discussion  **Control:** 30 hrslecture, 68 hrs cadaver lab |
| O’Connor et al, 2016 | Quasi-experimental  1+1+1+1+1=5 | | Medicine, radiology | 4 wk clerkships, sessions of 70-75 min, 2 topics | **Experimental:** pre-class prep, 70-75 min interactive workshop  **Control:** pre-class prep, 65-70 min didactic lecture |
| Pierce & Fox, 2012 | Experimental  1+1+0+1+1=4 | | Pharmacy 41% undergrad; 59% graduate | 1 renal module within an 8-wk course - 2 x wkly for 2 hrs.  Experimental: 2012  Control: 2011 | **Experimental:** pre-recorded lectures viewed prior to class and in-class time for instructor-led simulation case studies, games, and other activities  **Control:** 23 hrs of lecture, case discussion, review session prior to final |
| Rui et al., 2017 | Randomized control  1+1+1+1+1=5 | | Medicine | 3 units of 3 week class, 135 minutes each unit | **Experimental:** pre-class prep, in-class activity: interactive discussion regarding questions, concerns, problems, competitions  **Control:** traditional, lecture based learning |
| Tune et al., 2013 | Mixed-method\*  0+1+0+1+1=3 | | Medicine | 1 semester (Traditional - mammalian physiology) vs. 3 modules (Flipped – cardio-vascular, renal, respiratory) | **Experimental:** video podcasts of lectures viewed prior to class, interactive case studies/problem-solving during in-class sessions, quiz or homework (25% of grade)  **Control:** 1 hr lecture (recorded & posted online for both groups), optional class attendance, no quizzes |
| Whillier & Lystad, 2015 | Mixed method\*  retrospective  1+1+0+1+1=4 | | Undergrad neuroanatomy Chiropractic health | 1 session each of  Experimental: 2013  Control: 2011 | **Experimental:** 40 hrs/wk over 5 wks (face-to-face time, pre-recorded lecture, assigned reading, tutorial time doubled from 2 to 4 hrs, quizzes, worksheets, in-class group work (case studies, problem solving  **Control:** 36 hrs/wk over 6 wksface-to-face teaching, pre-recorded lectures, in-class attendance at lecture optional, no quizzes |

**\*** The qualitative portion did not address study outcomes.