**Appendix A: Search terms**

| ***Field 1*** | Field 2 | Field 3 | Field 4 |
| --- | --- | --- | --- |
| “active learning”  “collaborative learning”  “cooperative learning”  flipped  “inquiry based learning”  “just in time teaching”  “peer instruction”  “problem based learning”  “student response system”  “think-pair-share” | affective  “affective outcome”  “affective response”  “course evaluation”  discomfort  motiva\*  “student attitudes”  “student evaluation” “student feedback” “student perception” “student resistance” “student response” | Astronomy  bioengineering  biology  chemistry  “computer science”  engineer\*  “engineering education”  “environmental science”  geoscience  “life sciences”  “materials science”  math  physics  statistics  “STEM education” | college  “higher education”  institution  undergraduate university |
| ***Field 5*** |
| “high school”  K–12  “middle school”  “pre-college”  “primary education” “secondary education” “vocational education” |

**Appendix B: Systematic review screening flowchart**

Studies for qualitative analysis of negative student response

(*n* = 57)

Studies for analysis

(*n* = 431)

Full texts screened

(*n* = 679)

Studies removed due to reporting only positive student response

(*n* = 374)

Studies removed due to inclusion criteria

(*n* = 248)

Studies removed due to missing full texts

(*n* = 67)

Studies included in Full Text Review

(*n* = 746)

Studies removed due to inclusion criteria

(*n* = 1618)

Studies identified from database search and screening

(*n* = 2364)

**Appendix C: List of studies**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Reference** | **Reasons behind negative student responses** | | | | | |
|  | Perception of limited value | Lack of time, difficulty, and workload | Lack of guidance | Logistical difficulties | Unfamiliarity with AL | Lack of student preparation and confidence |
| (Arnesen et al., 2013) | X |  |  |  |  |  |
| (Autin et al., 2013) |  |  | X |  |  |  |
| (Bailey & DeBartolo, 2007) | X |  |  |  |  |  |
| (Berkling & Zundel, 2013) |  | X |  |  | X |  |
| (Galand, et al., 2010) |  | X |  | X |  |  |
| (Golter et al., 2007) |  | X |  |  |  |  |
| (Gok, 2012) |  | X |  |  |  |  |
| (Laatsch et al., 2005) | X |  |  |  | X |  |
| (Li, Zhao, & Shi, 2009) |  | X |  |  |  |  |
| (Lunsford & Herzog, 1997) |  | X |  |  |  |  |
| (Lykke et al., 2014) | X | X |  |  |  |  |
| (Nepal, 2013) |  |  | X |  |  |  |
| (Nomme & Birol, 2014) | X | X |  | X |  |  |
| (Örnek et al., 2008) |  |  | X |  |  |  |
| (Pearce, 2009) |  | X |  |  |  |  |
| (Robson et al., 2012) | X | X |  | X | X |  |
| (Self & Widmann, 2010) |  |  |  | X |  |  |
| (Shankar et al., 2007) |  |  |  |  | X |  |
| (Soto-Johnson et al., 2009) | X | X |  | X |  |  |
| (Van Dijk et al., 2001) |  |  | X |  |  |  |
| (Walker et al., 2008) |  |  |  | X | X |  |
| (Wilke, 2003) | X | X |  | X |  |  |
| (Dori, et al., 2007) |  | X |  |  |  |  |
| (Breckler & Yu, 2011) |  | X |  |  |  |  |
| (Jun & Guang-ping, 2012) |  |  |  | X | X |  |
| (Crossgrove & Curran, 2008) | X |  |  |  |  |  |
| (Bunting & Cheville, 2009) |  |  |  |  | X |  |
| (Dal, 2013) |  |  |  | X |  | X |
| (Chen et al., 2006) |  |  |  |  |  | X |
| (King & Robinson, 2009) | X |  |  |  |  |  |
| (Lawanto, 2011) |  | X |  | X |  |  |
| (Lake, 2001) |  | X |  |  |  |  |
| (Yadav et al., 2010) |  | X |  |  |  |  |
| (Machemer & Crawford, 2007) |  | X |  |  |  |  |
| (Cooper et al., 2012) |  |  |  |  | X | X |
| (Rockland et al., 2013) |  |  |  |  |  | X |
| (Gaffney & Gaffney, 2013) |  |  |  |  | X |  |
| (Chini et al., 2013) |  |  | X |  |  |  |
| (Cicek, 2015) |  | X |  | X | X |  |
| (Gaskins et al., 2015) |  | X |  | X |  |  |
| (Weaver & Sturtevant, 2015) |  | X |  | X |  |  |
| (Shekhar et al., 2015) |  |  |  |  | X |  |
| (Khoo et al., 2015) |  | X |  |  |  |  |
| (Turner, 2015) |  |  |  |  | X |  |
| (Simpson & Richards, 2015) |  | X |  | X |  |  |
| (Schoening et al., 2015) |  | X |  | X |  |  |
| (Cilli-Turner, 2015) |  | X |  |  |  |  |
| (Stehling et al., 2016) |  | X |  |  |  |  |
| (Meyers & Cripe, 2015) |  | X |  |  |  |  |
| (Triantafyllou et al., 2015) | X | X |  |  |  |  |
| (Khanova et al., 2015) | X | X |  | X | X |  |
| (Rein & Brookes, 2015) |  |  |  | X | X |  |
| (Ramlo, 2015) |  | X |  |  |  |  |
| (Chen et al., 2015) |  |  |  | X | X |  |
| (Reddy et al., 2015) |  |  |  | X |  |  |
| (Bailey, 2015) |  |  |  |  |  | X |
| (Berjon et al., 2015) |  | X |  |  |  |  |