

# PRISMA 2020 Checklist - Completed

## Systematic Review: Reimagining Higher Education: The Promise and Challenges of Competency-Based Learning in the Digital Age

Author: Hany Zaky | Journal: Knowledge 2026 | DOI: <https://doi.org/10.3390/knowledge6030015>

From: Page MJ et al. The PRISMA 2020 statement: an updated guideline for systematic reviews. BMJ 2021;372:n71. doi:10.1136/bmj.n71 | CC BY 4.0

| Section and Topic    | Item # | Checklist Item                                                                                                                                                                                            | Location Where Item is Reported                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TITLE                |        |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Title                | 1      | Identify the report as a systematic review.                                                                                                                                                               | Title page: "Reimagining Higher Education: The Promise and Challenges of Competency-Based Learning in the Digital Age" — subtitle and section header both read "Systematic Review"                                                                                                                                                                                                                                                 |
| ABSTRACT             |        |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Abstract             | 2      | See the PRISMA 2020 for Abstracts checklist.                                                                                                                                                              | Abstract (p. 1): Features a structured format with sub-headings for Purpose, Methods, Results, and Conclusions. Details the search strategy, eligibility criteria, total included studies (n = 73), thematic synthesis approach, inter-rater reliability ( $\kappa$ = 0.79), six identified themes, and main conclusions.                                                                                                          |
| INTRODUCTION         |        |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Rationale            | 3      | Describe the rationale for the review in the context of existing knowledge.                                                                                                                               | Section 1.2 (Literature Gap and Research Rationale, pp. 3–4): Highlights three gaps—previous reviews are limited to individual disciplines; reviews before 2015 do not account for digital transformation; and there is no existing synthesis that integrates institutional case studies with peer-reviewed empirical evidence on implementation and digital technology.                                                           |
| Objectives           | 4      | Provide an explicit statement of the objective(s) or question(s) the review addresses.                                                                                                                    | Section 1.3 (Research Question and Objectives, p. 4): The research question is clearly stated, accompanied by six numbered objectives that address implementation effectiveness, student outcomes, barriers, workforce alignment, sustainability, and equity.                                                                                                                                                                      |
| METHODS              |        |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Eligibility criteria | 5      | Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.                                                                                               | Section 2.2 (Eligibility Criteria, pp. 4–5): Four inclusion dimensions—Time Frame (2015–Dec 2025), Educational Level (post-secondary), Publication Type (peer-reviewed articles, conference papers, and accredited institutional case-study reports), and Topical Relevance (five CBE constructs). Exclusions include K–12-only materials, grey literature not from accredited institutions, out-of-scope content, and duplicates. |
| Information sources  | 6      | Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted. | Section 2.1 (Search Strategy, pp. 4–5): Four sources include Google Scholar (date filter: 2015–December 2025), ERIC (peer-reviewed, full-text, same date range), Scopus (2015–2025, Education subject area), and specific institutional case-study repositories. The date range ends in December 2025.                                                                                                                             |

|                               |            |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Search strategy               | <b>7</b>   | Present the full search strategies for all databases, registers and websites, including any filters and limits used.                                                                                                                                                                                 | Section 2.1 (pp. 4-5): Four keyword clusters are listed: "Competency-Based Education," "Traditional Teaching and Students' Competencies," "Credit System and Students' Achievement Measures," and "Competency-Based Education and Workforce." Filters are specified per database. Full documentation is available on OSF ( <a href="https://osf.io/avtp2/">https://osf.io/avtp2/</a> ). Limitation of Google Scholar is noted (no Boolean operators). |
| Selection process             | <b>8</b>   | Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.                     | Section 2.3 (Screening Process and PRISMA Flow, pp. 5–6): Involves title and abstract screening, then full-text review. Eligibility criteria are applied at each step. Inter-rater reliability ( $\kappa = 0.79$ ) was assessed on a 20% subsample ( $n = 15$ ) and reported in Section 2.4. One primary reviewer conducts the screening, with an independent second reviewer performing a reliability check.                                         |
| Data collection process       | <b>9</b>   | Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process. | Section 2.4 (Quality Appraisal and Data Synthesis, p. 6): A structured extraction matrix records author, year, study design, sample details, CBE model type, main findings, and limitations. Data is also available on OSF ( <a href="https://osf.io/avtp2/">https://osf.io/avtp2/</a> ).                                                                                                                                                             |
| Data items                    | <b>10a</b> | List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.                        | Sections 1.3 and 2.4 (pp. 4, 6–7) outline desired outcomes across six thematic areas: student-centered outcomes (such as completion, retention, and satisfaction), assessment reliability and validity, pacing flexibility, implementation process factors, workforce alignment indicators, and equity/challenge data. All relevant results that are compatible with these goals have been extracted.                                                 |
|                               | <b>10b</b> | List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.                                                                                         | Section 2.4 (p. 6): Extraction matrix includes variables such as author, year, study design, sample characteristics, CBE model type, institutional context, main findings, and limitations. Any sources that were inaccessible were obtained through inter-library requests prior to the full-text review (Section 2.3).                                                                                                                              |
| Study risk of bias assessment | <b>11</b>  | Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.                                    | Section 2.4 (pp. 6–7): MMAT (2018) assesses peer-reviewed studies across five domains: selection bias, performance bias, detection bias, attrition bias, and reporting bias. An adapted framework was used for institutional case studies, considering the absence of matched groups and reliance on self-report. The overall bias was rated as moderate to high (Section 2.4, p. 7).                                                                 |
| Effect measures               | <b>12</b>  | Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.                                                                                                                                                                  | Sections 3.1–3.6 include a qualitative thematic synthesis without a meta-analysis. Effect sizes are reported where available from individual studies, such as $d = 0.43$ — Porter & Polikoff; $d = 0.31$ – $0.47$ — Henri et al.; and $ICC \geq 0.75$ — Vargas et al. Evidence strength ratings (HIGH/MODERATE/LOW) are applied throughout the results.                                                                                               |
| Synthesis methods             | <b>13a</b> | Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and                                                                                                                                                     | Sections 2.3–2.4 (pp. 5–7): All 73 included studies contributed to the thematic synthesis. They were organized by thematic relevance following Braun & Clarke's                                                                                                                                                                                                                                                                                       |

|                           |            |                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           |            | comparing against the planned groups for each synthesis (item #5)).                                                                                                                                                                                         | (2006) six-phase framework. Source counts for each theme are provided at the beginning of each theme section.                                                                                                                                                                                                                                                                                                   |
|                           | <b>13b</b> | Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.                                                                                                       | Section 2.4 (p. 6): Utilizes a structured extraction matrix; no statistical transformations are applied. Conducts a qualitative thematic synthesis, with convergent and divergent findings combined narratively. Lower-quality sources with partial or limited data are marked with advisory notes.                                                                                                             |
|                           | <b>13c</b> | Describe any methods used to tabulate or visually display results of individual studies and syntheses.                                                                                                                                                      | Sections 3.2–3.5 and 4.7 include Tables 1–6, which show comparative data on CBE versus traditional methods, competency frameworks, assessment rubrics, implementation timelines, technology checklists, and cross-case comparisons. Additionally, Figure 1 (PRISMA flow) and Figure 2 (CBE-CFF diagnostic quadrant) offer visual representations.                                                               |
|                           | <b>13d</b> | Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used. | Section 2.4 (p. 6): Six-phase thematic synthesis based on Braun & Clarke (2006). Rationale: Due to the heterogeneity in study designs, outcome measures, and institutional contexts, meta-analysis was not feasible. Instead, a narrative synthesis with evidence-strength labels (MODERATE/LOW) was employed throughout.                                                                                       |
|                           | <b>13e</b> | Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).                                                                                                                        | Sections 3.1–4.7: Heterogeneity explored through cross-case analysis (Section 3.5.6, Table 6) and the CBE Contextual Fit Framework (CBE-CFF, Section 4.7, Figure 2), which identifies four contextual moderators — student self-regulatory capacity, employer partnership intensity, technology infrastructure maturity, and accreditation flexibility.                                                         |
|                           | <b>13f</b> | Describe any sensitivity analyses conducted to assess robustness of the synthesized results.                                                                                                                                                                | Section 4.9 (p. 23): No formal sensitivity analyses were performed. Instead, robustness was evaluated by stratifying studies according to quality tiers (adequate, partial, limited — MMAT) and by cross-validating Google Scholar findings with ERIC and Scopus. Lower-tier sources were not used as the sole basis for any conclusions.                                                                       |
| Reporting bias assessment | <b>14</b>  | Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).                                                                                                                                     | Section 2.4 (pp. 6–7) and Section 4.9 (p. 23): Reporting bias was evaluated through the five-domain MMAT framework (focused on selective outcome reporting). The inability to reproduce results on Google Scholar was identified as a transparency limitation. It was observed that evidence of benefits mainly relied on single-site institutional reports, whereas evidence of challenges was less prominent. |
| Certainty assessment      | <b>15</b>  | Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.                                                                                                                                                       | Sections 2.4, 3.1–3.6, and 4.1–4.4 use MMAT quality tiers (adequate, partial, limited). Evidence strength labels (MODERATE, LOW) are included with key findings in the Results and Discussion sections. No formal GRADE assessment was performed; evidence labels function as an equivalent signal.                                                                                                             |
| <b>RESULTS</b>            |            |                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Study selection           | <b>16a</b> | Describe the results of the search and selection process, from the number of records identified in                                                                                                                                                          | Section 2.3 (pp. 5–6) and Figure 1 (p. 6): 225 records identified; 125 duplicates removed; 100 screened; 27 excluded (5 title/abstract, 13 topical relevance, 9 out                                                                                                                                                                                                                                             |

|                               |            |                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               |            | the search to the number of studies included in the review, ideally using a flow diagram.                                                                                                                                                                                            | of scope/temporal); 73 full texts assessed; 0 excluded at full-text stage; 73 included (68 peer-reviewed + 5 case studies). PRISMA 2020 flowchart provided.                                                                                                                                                                                                                                                                                                                                                                                               |
|                               | <b>16b</b> | Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.                                                                                                                                                          | Section 2.3 (pp. 5–6): Records were excluded if they fell into categories such as outside the post-secondary scope, conducted outside the specified time frame (pre-2015 or after Dec 2025), had insufficient relevance to the five CBE constructs, or were duplicates. Pre-2015 foundational works are kept as contextual references but are not included among the 73 studies listed.                                                                                                                                                                   |
| Study characteristics         | <b>17</b>  | Cite each included study and present its characteristics.                                                                                                                                                                                                                            | Sections 3.1–3.6 and Tables 1–6 organize characteristics thematically. The data extraction matrix in Section 2.4 records details such as author, year, design, sample, CBE model, findings, and limitations for each source. A comparison across five institutional programs is provided in Table 6 (Section 3.5.6).                                                                                                                                                                                                                                      |
| Risk of bias in studies       | <b>18</b>  | Present assessments of risk of bias for each included study.                                                                                                                                                                                                                         | Section 2.4 (pp. 6–7) and throughout Sections 3–4: The overall bias is rated as moderate to high, primarily due to selection bias and reliance on self-report. Risk-of-bias ratings are included alongside relevant findings. A complete summary is accessible in the Supplementary content (OSF: <a href="https://osf.io/avtp2/">https://osf.io/avtp2/</a> ). Specific biases are identified for each theme, such as in Section 3.3 — selection bias in pacing literature; and in Section 4.2 — five out of six comparative studies lack matched groups. |
| Results of individual studies | <b>19</b>  | For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.                                                     | Sections 3.1–3.6: Individual study results are described narratively within themes, including quantitative data where available—such as differences in completion rates, effect sizes, inter-rater reliability coefficients, and coach-to-student ratios. These results are not displayed in a formal forest plot, aligning with a qualitative synthesis.                                                                                                                                                                                                 |
| Results of syntheses          | <b>20a</b> | For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.                                                                                                                                                                               | Sections 3.1–3.6 each start with a source count and methodological notes. The MMAT quality tiers, detailed in the Section 3 introduction, include 71% adequate, 22% partial, and 7% limited. The overall bias risk is described for each theme.                                                                                                                                                                                                                                                                                                           |
|                               | <b>20b</b> | Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect. | No meta-analysis conducted. Qualitative thematic synthesis results presented in Sections 3.1–3.6. Where quantitative data are available, direction and magnitude are reported (e.g., completion rate advantages of 8–24 percentage points across six comparative studies — Section 4.2).                                                                                                                                                                                                                                                                  |
|                               | <b>20c</b> | Present results of all investigations of possible causes of heterogeneity among study results.                                                                                                                                                                                       | Sections 3.5.6 and 4.7: Cross-case analysis (Table 6) and CBE-CFF (Figure 2) identify and explain sources of outcome heterogeneity across different institutional types. Four contextual moderating factors are documented.                                                                                                                                                                                                                                                                                                                               |
|                               | <b>20d</b> | Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.                                                                                                                                                                           | Section 4.9 (p. 23): No formal sensitivity analyses conducted. Instead, evidence is weighted by quality tiers (adequate > partial > limited), and Google Scholar results are validated across multiple databases to serve as robustness checks.                                                                                                                                                                                                                                                                                                           |
| Reporting biases              | <b>21</b>  | Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.                                                                                                                                                              | Sections 2.4, 3.6.2, and 4.9: Evidence of benefits mainly comes from single-site institutional reports, which carry a higher risk of reporting bias; challenges are supported by multi-site comparative studies, which have a lower bias risk. It is also                                                                                                                                                                                                                                                                                                 |

|                           |            |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                           |
|---------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           |            |                                                                                                                                                | acknowledged that Google Scholar's unstructured search might have overlooked relevant studies.                                                                                                                                                                                                                                            |
| Certainty of evidence     | <b>22</b>  | Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.                                            | Throughout Sections 3–4, evidence strength labels are explicitly assigned to each major finding — for example, completion rate advantage: LOW (Section 4.2); workforce alignment benefits: MODERATE (Section 4.4); and equity benefits: not empirically confirmed (Section 4.6). These labels are displayed in brackets within the text.. |
| <b>DISCUSSION</b>         |            |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                           |
| Discussion                | <b>23a</b> | Provide a general interpretation of the results in the context of other evidence.                                                              | Section 4, paragraphs 4.1–4.6 (pp. 19–21): The results are analyzed based on the six objectives, considering previous systematic reviews (Henri et al., 2017; Kang et al., 2025; Telling & Serapioni, 2025) and the current policy landscape.                                                                                             |
|                           | <b>23b</b> | Discuss any limitations of the evidence included in the review.                                                                                | Sections 4.2, 4.4, 4.6, and 4.9 discuss the methodological limitations of the included studies, including the absence of randomized trials, high risk of selection bias, dependence on institutional self-reports, lack of analyses for demographic subgroups, and variability in how mastery thresholds are defined.                     |
|                           | <b>23c</b> | Discuss any limitations of the review processes used.                                                                                          | Sections 2.1 and 4.9 (pp. 5, 23): Google Scholar lacks support for structured Boolean operators — a reproducibility constraint that is partly addressed through cross-validation with ERIC and Scopus. There is no PROSPERO pre-registration. Relying mainly on English-language sources may restrict the generalizability.               |
|                           | <b>23d</b> | Discuss implications of the results for practice, policy, and future research.                                                                 | Sections 4.5 (five evidence-based recommendations, p. 20), 4.7 (CBE-CFF framework, pp. 21–22), 4.8 (policy implications for federal regulators, accreditors, and state agencies, pp. 22–23), and 4.9 (future research directions, pp. 23–24).                                                                                             |
| <b>OTHER INFORMATION</b>  |            |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                           |
| Registration and protocol | <b>24a</b> | Provide registration information for the review, including register name and registration number, or state that the review was not registered. | Section 4.9 (p. 24) and Data Availability Statement (p. 25): The review was not pre-registered in PROSPERO. The authors recommend pre-registering protocols for future reviews. This limitation is explicitly acknowledged.                                                                                                               |
|                           | <b>24b</b> | Indicate where the review protocol can be accessed, or state that a protocol was not prepared.                                                 | Data Availability Statement (p. 25): No formal protocol prepared. Supplementary data, including search documentation and extraction materials, available on OSF at <a href="https://osf.io/avtp2/">https://osf.io/avtp2/</a> .                                                                                                            |
|                           | <b>24c</b> | Describe and explain any amendments to information provided at registration or in the protocol.                                                | Not applicable — the review was neither pre-registered nor had a protocol prepared.                                                                                                                                                                                                                                                       |
| Support                   | <b>25</b>  | Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.                  | Funding Statement (p. 25): This research received no external funding.                                                                                                                                                                                                                                                                    |

|                                                |    |                                                                                                                                                                                                                                            |                                                                                                                                                                                                           |
|------------------------------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                |    |                                                                                                                                                                                                                                            |                                                                                                                                                                                                           |
| Competing interests                            | 26 | Declare any competing interests of review authors.                                                                                                                                                                                         | Conflicts of Interest Statement (p. 25): The author declares no conflicts of interest.                                                                                                                    |
| Availability of data, code and other materials | 27 | Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review. | Data Availability Statement (p. 25): Extraction matrix, search documentation, and supplementary risk-of-bias summary are accessible on OSF at <a href="https://osf.io/avtp2/">https://osf.io/avtp2/</a> . |