

Assessment of Self-directed Learning Tools in Undergraduate Medical Education: A Systematic Review

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Introduction

- Self-directed learning (SDL) is defined as “a process in which individuals take the initiative, in diagnosing their learning needs, formulating goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes”.¹
- The Liaison committee for medical education (LCME) has enforced this need for SDL and most recently in November of 2023 stated “Faculty of a medical school ensure that the medical curriculum includes self-directed learning experiences... to allow medical students to develop the skills of lifelong learning”.²
- Multiple studies examine self-directed learning in undergraduate medical education, with the emphasis that self-directed learning is paramount to medical education.³⁻⁵ However, no systematic review has critically evaluated the assessment tools used to measure SDL effectiveness in the undergraduate medical school curriculum.

Aims and Objectives

- Identify assessment instruments used for evaluating SDL activities and outcomes in undergraduate medical education.
- Evaluate and compare the psychometric properties of the SDL assessment tools to better understand the efficacy of these tools in evaluating SDL activities and outcomes.

Methods

Search Strategy

- Databases:** PubMed, Embase, PsycINFO, ERIC and SCOPUS
- Keywords:** “Self-directed learning”, “SDL”, “Medical student”, “Undergraduate medical education”, “Medical school”, “Psychometrics”, and “Course evaluation”.

Screening

- 2-step approach performed through Covidence platform with two reviewers independently conducting title/abstract screening and full-text selection. Disagreements were resolved by consensus or a third reviewer.
- The PRISMA flow diagram was used to complete the screening process, as depicted in figure 1.⁶

Inclusion Criteria

- Studies that both used an SDL assessment tool in an undergraduate medical education setting and reported original psychometric data.

Exclusion Criteria

- Not a study, other health profession students, published in languages other than English, without full text content and without empirical data.

Data Extraction

- A standardized data extraction form was created and piloted on two sample studies. Extraction of data was performed through Covidence online platform.

Results

Figure 1: PRISMA flow diagram of article selection process

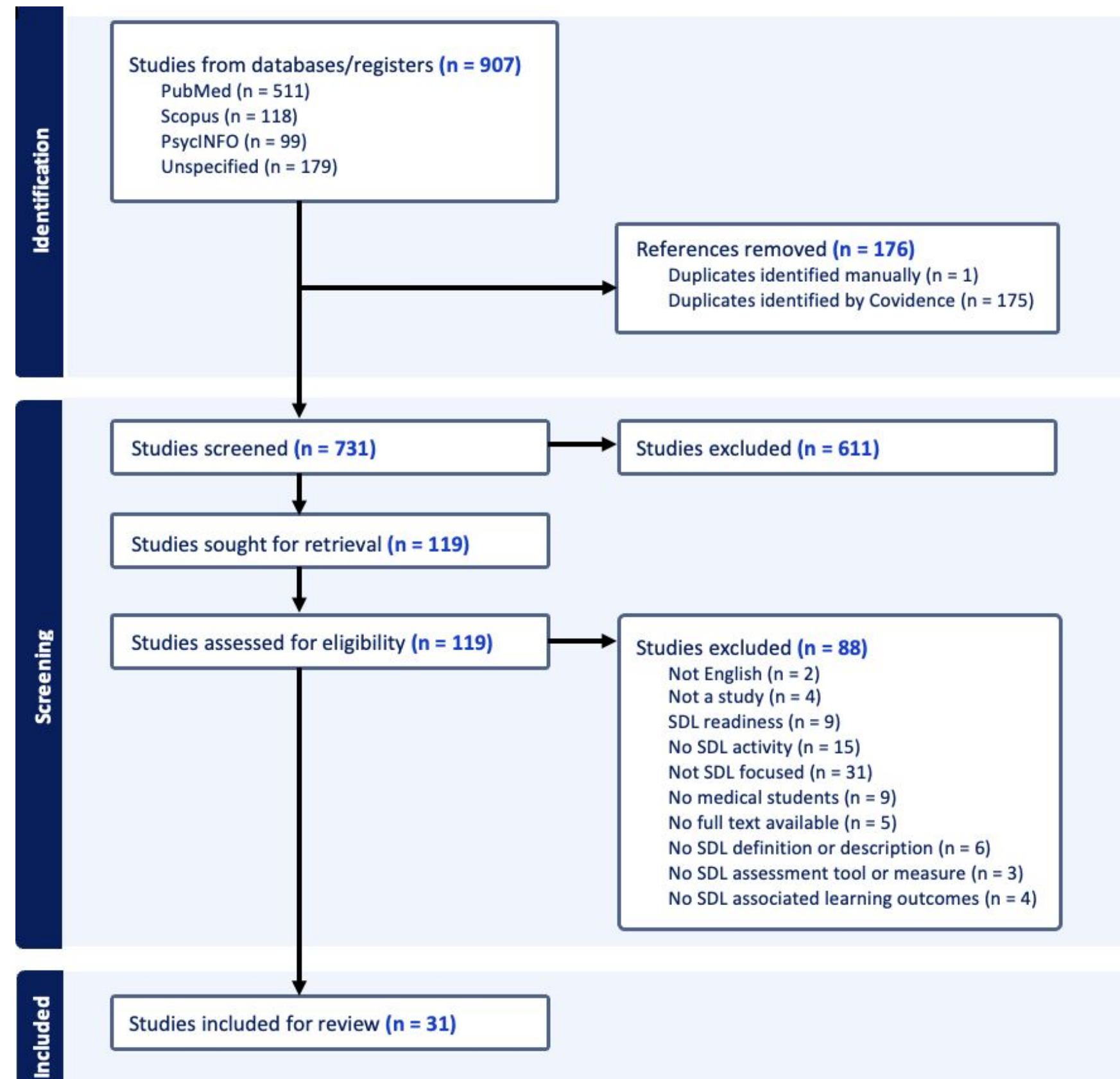
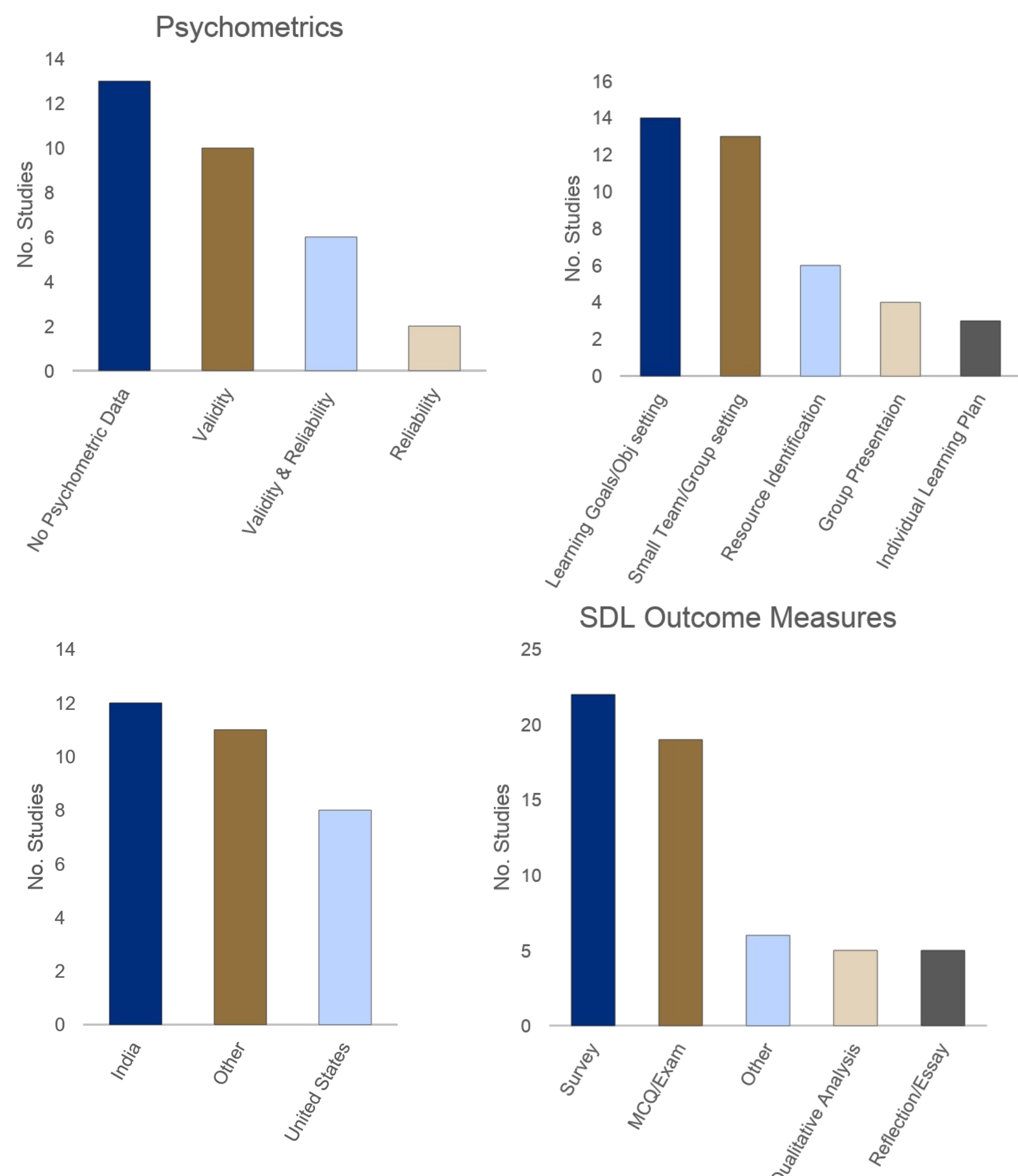


Figure 2: Reported study characteristics of identified articles

Design	Student Populations	Setting
- Qualitative (n=1) - Quantitative (n=14) - Mixed Method (n=14)	- M1 Year (n=11) - M2 Year (n=2) - M3 Year (n=2) - M4 Year (n=4) - Other (n=12)	- Clinical (n=12) - Preclinical (n=18) - Other (n=1)

Figure 3: Summary of attributes of included studies



Key Results

Table 1: Results of 8 studies conducted in the United States.⁷⁻¹⁴

Articles	Educational setting	SDL Outcome Measures	Results
Strowd et al.	M3 Clinical (neurology clerkship)	NBME shelf exam Faculty/resident SDL rating Satisfaction survey	After adjusted analysis (adjusted for age and training) showed that goal achievement was associated with a score increase of +1.7 points (95% CI 0.1-3.2, P=0.04). Unadjusted analysis found no significant difference between groups (p=0.20). Goal achieving students demonstrated higher observed tendency towards SDL (4.5 ± 0.5 vs 4.1 ± 0.8, P<0.0001). Goal achieving students reported significantly higher clerkship satisfaction (4.2 0.8 vs 2.8 1.0, P<0.0001).
Kastenmeier et al.	M3 clinical (surgery clerkship)	NBME surgery Subject examination (SSE) Student Survey	Surgery ILP implementation was associated with a statistically significant NBME SSE increase of 74.9 to 76.6; p=0.042; d=0.21. Students agreed that ILPs improved Medical knowledge: 81.8% (agree/strongly agree), Patient care skills: 60.0% (agree/strongly agree) and increased NBME SSE preparedness: 80.6% (agree/strongly agree).
Ghosh et al.	M3 clinical (Neurology Clerkship)	NeuroSAE performance Post-course survey Thematic analysis	NeuroSAE (online self assessment exam (SAE)) performance demonstrated a mean student score of 79.34% in the study compared to the national average of 69.11% (functioned as a formative assessment and is not a validated summative outcome). Garrison SDL framework analyzed students' perceptions of SAE and identified themes of factors that supported SDL behaviors. Theme I: self-management—autonomy, flexible pace Theme II: self-monitoring—broaden knowledge content, encourage critical self reflection Theme III: Motivation—Perceived value for patient care, perceived value for certification exam preparation
Clay et al.	M4 Clinical capstone transition course	Survey	Students self assessment of their confidence in SDL increased following course completion. 69% of students indicated that the CaPOWs helped them identify knowledge deficits.
Chitkara et al.	M4 clinical advanced clinical experience	Validated survey (MSLQ) Qualitative Reflections	From self reflections students noted that they felt the process of writing ILPs allowed them to improve on knowledge and skills, and pushed them to identify their own strengths and weaknesses. Measurable improvements in SDL-related domains were reported using MSLQ. Two of the four SDL subdomains identified on the MSLQ showed improvement: self efficacy (p=0.001), and self regulation (p=0.002). ⁵
Hill et al.	M1 Preclinical infectious disease course	Survey Qualitative thematic analysis	Survey responses demonstrated that 85% of students believed that the project contributed to lifelong learning skills. 93% agreed that they obtained new clinical knowledge.
Kemp et al.	M3-M4 Clinical elective	Likert Survey Qualitative analysis	Analysis of free responses demonstrated that students felt the course prepared them for their future practice, and that the course furthered their understanding of SDL. The percentage of students that responded agree or strongly agree was 100% for questions related to whether the course furthered the understanding of SDL, was beneficial for their future practice, helped them prepare to educate others about covid, and if they would recommend this course to other students.
Zheng	M1-M2 Preclinical flipped curriculum	Semi structured interviews Qualitative thematic analysis	Technology use and collaborative SDL studies mainly contributed mechanistic insights rather than quantitative outcome changes. Medical students reported 4 types of technologies for learning: video sources (22/26), self assessment tools (20/26), management tools (19/26), social media (12/26).

Study Characteristics:⁷⁻³⁷

- Study design:** Quantitative (n=14), Mixed Methods (n=14), Qualitative 9n=1)
- Participants:** Most M1 student participants
- Setting:** Most Preclinical (n=18) (Figure 2)

Psychometrics:⁷⁻³⁷

- Majority of studies contained either validity (n=10), reliability (n=2) or both validity and reliability (6) data. A subset of studies (n=13) lacked psychometric data. (Figure 3)

Intervention Characteristics:⁷⁻³⁷

- Most utilized learning goals/objective setting (n=14) followed by small team/group setting (n=13). (Figure 3)

Geographic distribution:⁷⁻³⁷

- Most studies conducted in India (n=12). (Figure 3)

Outcome Measures:⁷⁻³⁷

- Surveys (n=22) and MCQ/Exams (n=19) were the most utilized. (Figure 3)

Discussion

- This review identified 31 studies assessing SDL in UME, revealing significant heterogeneity in both interventions and assessment methods.
- Interventions frequently incorporated goal setting and small group learning.
- Across studies SDL interventions were consistently associated with positive learner reported outcomes.
- Individual learning plan (ILP) based interventions were particularly associated with improved preparedness and statistically significant NBME exam performance.

Limitations:

- Measurement heterogeneity:** Assessment tools varied widely.
- Limited psychometric reporting:** Only 6 of 31 studies reported both validity and reliability data raising concern regarding measurement rigor and interpretability of findings.
- Limited objective academic performance:** Standardized exams were infrequently utilized.

Conclusions and Future Directions

- Current evidence for SDL effectiveness relies heavily on positive learner perceptions rather than objective performance data.
- Only 6 of 31 studies reported robust psychometric data, indicating a critical need for more rigorous validation of SDL assessment tools.
- Despite this, interventions like Individual Learning Plans (ILPs) show early promise for improving performance on standardized exams.

Future Directions:

- Validate SDL Instruments:** Prioritize research establishing the validity and reliability of instruments measuring SDL behaviors and outcomes.
- Incorporate Objective Metrics:** Integrate direct faculty observations and performance-based outcomes (e.g., clerkship grades, board scores), alongside self-reports.
- Conduct longitudinal studies:** Investigate whether early SDL skills predict long-term habits and clinical performance during residency.

References

