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1 **Instruments to measure the ability to self-reflect: A systematic review of evidence from**
2 **workplace and educational settings including health care**

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24 project and Professor Martyn Sherriff for statistical advice.

25 **Abstract**

26 **Introduction:** Self-reflection has become recognised as a core skill in dental education,
27 although the ability to self-reflect is valued and measured within several professions. This
28 review appraises the evidence for instruments available to measure the self-reflective ability
29 of adults studying or working within any setting, not just healthcare.

30 **Materials and Methods:** A systematic review was conducted of 20 electronic databases
31 (including Medline, ERIC, CINAHL and Business Source Complete) from 1975 to 2017,
32 supplemented by citation searches. Data was extracted from each study and the studies graded
33 against quality indicators by at least two independent reviewers, using a coding sheet.
34 Reviewers completed a utility analysis of the assessment instruments described within
35 included studies, appraising their reported reliability, validity, educational impact,
36 acceptability and cost.

37 **Results:** 131 studies met the inclusion criteria. 18 were judged to provide higher quality
38 evidence for the review and three broad types of instrument were identified, namely: rubrics
39 (or scoring guides), self-reported scales and observed behaviour.

40 **Conclusions:** Three types of instrument were identified to assess the ability to self-reflect. It
41 was not possible to recommend a single most effective instrument due to under reporting of
42 the criteria necessary for a full utility analysis of each. The use of more than one instrument
43 may therefore be appropriate dependent on the acceptability to the faculty, assessor, student
44 and cost. Future research should report on the utility of assessment instruments and provide
45 guidance on what constitutes thresholds of acceptable or unacceptable ability to self-reflect,
46 and how this should be managed.

47

48

49 **Introduction**

50 The ability to self-reflect is an acknowledged core skill for all healthcare
51 professionals, including dentists (1-5). With the emergence of outcomes-based education in
52 healthcare (6, 7), there is an increasing focus on describing a number of wide-ranging
53 competences that need to be assessed prior to registration. This includes continuous,
54 systematic and self-directed reflection on practice, with appropriate action to improve patient
55 care (2, 5, 8, 9). However, assessing and measuring primarily metacognitive processes, such
56 as self-reflection, presents unique challenges, as they cannot by their very nature, be observed
57 directly. Whilst there is understandable controversy regarding whether it is appropriate to
58 view reflective ability as a technical competence that can be robustly assessed (10), the
59 expectation of outcomes-based curricula means that curriculum developers must try to
60 address this issue. An initial search of the literature failed to find a systematic review of
61 instruments available to assess the ability to self-reflect. However, it became clear that
62 cultivating individuals who have the ability to self-reflect is considered essential within a
63 number of disciplines in addition to healthcare, including management and organisational
64 research (11, 12), accountancy (13), the ministry (14), teaching within primary or secondary
65 education (15, 16), social work (17), higher education (18, 19) and leadership (20, 21). There
66 was broad agreement across disciplines that self-reflection is an important skill which is
67 difficult to observe and complex to assess (22-25). Current approaches to reflective practice in
68 the education of healthcare professionals has been challenged as being out of step with the
69 theory of reflection (10), with there being a trend towards ritualistic or utilitarian written
70 reflection (26, 27). A wider search for instruments used to measure self-reflection in
71 disciplines outside healthcare, including an evaluation of the evidence available to support
72 their use, may further inform the assessment of self-reflection within dental education.

73 To date the assessment of self-reflection within healthcare education has largely
74 focused on the importance and application of reflection (24, 28) rather than the utility of
75 available instruments to measure it. Utility describes, predicts or explains the usefulness of

76 decision options, for example in the estimation of the value of human resource programmes
77 in business (29). One such model of utility used to evaluate assessments of competency in
78 healthcare has been described by van der Vleuten (30). This model comprises five criteria,
79 namely: reliability, validity, educational impact, acceptability (to stakeholders) and cost (in
80 terms of the resources required, including time). It is recognised that the evaluation of the
81 utility of any assessment tool against a list of predefined criteria such as this, would be helpful
82 in the education of healthcare professionals (31).

83 An initial appraisal of the literature informed our research question, namely: What
84 instruments are available to measure self-reflection and what is the evidence to support their
85 use? This systematic review aimed to identify which assessment instruments are currently
86 available to measure the ability to self-reflect in either workplace or educational settings for
87 any vocation, not just healthcare; to explore and synthesise currently available evidence
88 relating to the assessment instruments and to promote 'best evidence' approaches to
89 assessment of self-reflection that could be applied to dental education. The utility of each
90 instrument was assessed against five criteria suggested by van der Vleuten (30), namely:
91 reliability, validity, educational impact, acceptability and cost.

92

93 **Materials and Methods**

94 Twenty electronic databases were searched for the period January 1975-August 2017,
95 which included six core electronic databases, namely: Medline, Embase, CINAHL
96 (Cumulative Index to Nursing and Allied Health Literature), ERIC (Education Resource
97 Information Centre), British Education Index and PsycINFO, and 14 additional electronic
98 databases. The following terms were used in the search strategy (Figure 1) in various
99 combinations in order to address the research question: education, teaching, university (or)
100 college, (or) further education, (or) school; personnel management, staff development,
101 management, educational measurement (including assessment); tool (or) instrument, (or)
102 scale, (or) test. Further terms were truncated (*) to allow for variation of the root word, for

103 example train*, in-service train*, work*, self-reflect*, self-aware*, self-regulat*. Slight
104 variation of the search strategy was required to match the structure of each database
105 (Appendix 1). Ancestral searches were performed to check for instruments or tools mentioned
106 within citations.


107 **Selection procedure** - All citations retrieved were imported to Endnote X7.5 reference
108 management software (Thomson Reuters, Philadelphia) and duplicate citations removed.
109 Firstly, the title and abstract of all identified citations were screened for inclusion against the
110 selection criteria (Table 1) by one reviewer (JCW), with 10% independently screened by a
111 second reviewer (MC). The inter-rater agreement determined using weighted Kappa was
112 acceptable (0.61) (32). Secondly, the full text of articles identified in the first stage were
113 assessed against the selection criteria by one reviewer (JCW) and once again 10% were
114 independently assessed by a second reviewer (MC). The inter-rater agreement for inclusion of
115 studies at the second stage, determined using weighted Kappa, was 0.88. Disagreement on
116 whether to include articles in the review was resolved by discussion between the two
117 reviewers.

118 The search was intentionally broad to include instruments used in all workplace and
119 educational settings, within and beyond healthcare. Studies of participants aged 16 years or
120 less were excluded as the focus of the review was on instruments that could be applied to
121 undergraduate dental professionals. For sources within healthcare, studies were excluded if
122 the self-reflective activity was undertaken by a patient. Opinion pieces, commentary articles,
123 studies that could not be retrieved and studies without primary data were also excluded.

124 **Data extraction and analysis** - A data extraction coding sheet was developed and piloted by
125 three members of the review team to report: the types of assessment instrument, the context of
126 use, who was tested, who rated the quality of self-reflection, details of any other criteria
127 measured at the same time (such as insight), evidence for repeated testing of the same
128 students and the utility of the instrument (reliability, validity, educational impact,

129 acceptability and cost). Following minor modification, the final electronic coding sheet was
130 created in Microsoft Excel (Appendix 2).

131 **Quality assessment of studies** – Each of the 131 studies that met the inclusion criteria was
132 assessed independently by at least two reviewers and the quality of evidence was scored using
133 a five point scale, based on the work of Harden et al. (33) and Cate et al. (34). The scores
134 ranged from 1 (low quality evidence) to 5, (high quality evidence) as shown below:

- | | |
|--------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1 - No clear conclusions can be drawn. Not significant | LOW QUALITY |
| 2 - Results ambiguous, but there appears to be a trend |  |
| 3 - Conclusions can probably be based on the results | |
| 4 - Results are clear and very likely to be true | |
| 5 - Results are unequivocal | |
| | |

135 The strengths and weaknesses of each study were noted as comments on the coding
136 sheet. If there was disagreement between the quality scores of two reviewers of two or more
137 points, a third reviewer was asked to review and score the study independently and any
138 discrepancies were discussed until consensus was reached. Only studies which received a
139 score of four or more from two independent reviewers were referred to as higher-scoring
140 studies and the utility of the instruments used in these studies forms the best evidence for this
141 review.

142 **Evidence synthesis** - The heterogeneity of the study designs in the higher-scoring studies
143 precluded meta-analysis of the quantitative data. Therefore, a descriptive synthesis was
144 undertaken by one reviewer (JCW) using the comments entered on the coding sheet by all
145 reviewers.

146

147 **Results**

148 This section is presented in 5 parts, namely: study selection process; methodological
149 characteristics of the higher-scoring studies; instruments used in the higher-scoring studies;
150 synthesis of evidence for each instrument and the reported utility of these instruments.

151 **Study selection process** - The PRISMA flow chart of the literature search and selection
152 process is shown in Figure 2. The primary database search yielded 9599 records and a further
153 51 records, not found in the primary search, were identified for screening following ancestral
154 searching of citations from included studies. After de-duplication, the remaining 3898 records
155 were then screened by title and abstract, leading to a total of 519 full-text articles being
156 retrieved. Of these, four studies could not be accessed and a further 384 failed the inclusion
157 criteria, leaving 131 studies included in the review. The most common reason for exclusion
158 was the absence of an instrument to measure self-reflection (n=212). The country of origin of
159 included studies was the USA (49 studies, 37%), UK (19 studies, 15%), Australia (14 studies,
160 11%), the Netherlands (12 studies, 9%), Brazil and Canada (5 studies each, 4%), Taiwan (4

161 studies, 3%), Belgium, Hong Kong, South Africa and Sweden (3 studies each, 2%) and other
162 countries (11 studies, 8%).

163 Despite searching for studies published after 1975, the earliest included paper was
164 1988. The majority of studies (98/131) had been published over the decade 2007-2017. As
165 expected from the initial literature search, included studies were drawn from a wide variety of
166 professional fields, namely Medicine or Surgery (60 studies), Nursing (16 studies), Teaching
167 (9 studies), Occupational Therapy or Physical Therapy or Physiotherapy (7 studies),
168 Dentistry, Pharmacy and Psychology (6 studies each), Dental hygiene or therapy (4 studies),
169 Management and Social work (3 studies each), Tennis Athletes, Royal Navy, Veterinary
170 Science (2 studies each), Chaplaincy, Midwifery, Music, Public Health and Counselling (1
171 study each). The included studies were published in 70 academic journals.

172 The weighted kappa value for inter-rater agreement on the quality of evidence score
173 between each pair of initial reviewers was 0.66 (95% CI 0.57,0.75), with 95% of coding being
174 either the same grade (64/131 studies) or within one grade (63/131 studies). The four
175 remaining studies, where the difference in the scores was 2 or more, were coded by a third
176 reviewer and the final grade decided by discussion to reach consensus. There were 18 higher-
177 scoring studies where both reviewers independently judged the study as score 4 (i.e. the
178 results are clear and very likely to be true) or score 5 (i.e. the results are unequivocal). The 18
179 higher-scoring studies provided the best evidence for the review whilst the remaining lower-
180 scoring studies (n=113) were judged to provide supporting evidence.

181 **Methodological characteristics of the higher-scoring studies** - The criteria that typified the
182 18 higher-scoring studies were:

- 183 • Larger sample sizes (14, 35-38).
- 184 • A clear study design (14, 35-51).
- 185 • An experimental (39-42) or pretest-posttest design (14, 38, 43-46).
- 186 • Measurements at multiple time-points during training (47-49).

187 • Measure of performance compared with measures of self-reflection. Such performance
188 measures included communication and professionalism (50), pastoral skills (14), writing
189 and story-telling skills (40), clinical judgement and diagnosis (49), scores for case-solving
190 and other skills/knowledge based tests (51), grades for written examinations and objective
191 structured clinical examinations (45), adherence to clinical guidelines (38), self-perceived
192 stress, coping behaviour and self-reported nursing competence (37).

193 • The use of previously-validated measures (35, 39, 42, 43, 46) along with recorded inter-
194 rater (39, 41, 42, 44) or both inter-rater and intra-rater reliability (36).

195 The characteristics of the higher-scoring studies are displayed in Table 2. The participants
196 within these studies were all undertaking some form of training within a healthcare
197 programme including dentistry (49), medicine (35,36,39-45, 51), nursing (37), physical
198 therapy (38) and chaplaincy in healthcare (14).

199 **Assessment instruments used in the higher-scoring studies** - This review identified three
200 broad types of instruments within the higher-scoring studies that have been used to measure
201 the ability to self-reflect (Figure 2), namely:

202 • Rubric (or scoring guide) (n=9)

203 This is an instrument used by another person (a rater or assessor) to evaluate a
204 participant's (e.g. student, trainee clinician) response(s) to a real or simulated situation
205 and against a set of pre-agreed criteria. The response is in the form of reflective writing
206 and the situation might be a clinical case, written vignette or video.

207 • Self-reported scale (n=7)

208 This instrument comprises a questionnaire for the participant to complete before and/or
209 after a period of study, with responses recorded using a Likert scale.

210 • Observed behaviour (n=2)

211 This is a measurement by an observer (rater or assessor) of a clinical performance, using
212 a scale, following self-reflection by the participant and a one-to-one discussion about the

213 clinical performance. Alternatively, both the observer(s) and the participant can score the
214 participant's clinical performance. The level of agreement between the self-score and the
215 observer's score is then used to determine the level of insight.

216 **Synthesis of evidence for each type of assessment instrument** - None of the higher-
217 scoring papers reported on all five utility criteria (reliability, validity, educational impact,
218 acceptability and cost) required for a full utility analysis of the three instruments. A synthesis
219 of reported evidence for each of the three instruments from the 18 higher-scoring studies is
220 shown in Table 3. The summary below describes the numbers of higher-scoring studies using
221 each instrument, who assessed or rated the level of self-reflection, and whether studies used
222 the instrument in a pretest-posttest study design. The educational impact of the instruments
223 was not reported within any of the higher-scoring studies. There was also limited information
224 regarding their acceptability to the raters (39, 49) or other stakeholders e.g. students or
225 patients. None of the higher-scoring studies reported the cost of instruments. However, the
226 review team looked for details of the time required to prepare material for each instrument, to
227 train raters and to conduct the assessment. These details informed an estimate of the costs for
228 each instrument.

229 **1. Rubrics (or scoring guides)**

230 Six rubrics (referred to in the remainder of the text as Rubrics A to F) were used
231 within nine higher-scoring studies to measure the self-reflective writing ability of medical
232 students or doctors undertaking postgraduate training. In each study the assessors were
233 clinical educators, although one study also engaged and trained two fourth-year medical
234 students as raters (42). Two of the six rubrics, A and C, were used within a pretest-posttest
235 study design. Rubric A was used to score reflective writing prior to a 9-hour medical ethics
236 course, with repeated measurement four weeks later (44), and Rubric C was used to score
237 reflective writing before and after ten months of undergraduate medical training (41). No
238 significant change in reflection scores was reported over time in either study (41, 44). One
239 study (42) compared two types of rubrics (Rubrics C and F).

240 Only two of the higher-scoring studies included information about the resources
241 required. One study reported the time taken to score reflective writing using Rubric E as an
242 average of four minutes per case (36), plus 30 minutes for rater training and five hours to train
243 simulated patients prior to filming the cases. The length of time taken for script-writing or
244 filming with the same rubric was not recorded (36). The time taken to train raters to score
245 with Rubric C was reported to be 2 hours, whilst initial training with Rubric F took 4 hours
246 (42). Further rater training was required for Rubric F due to drift in scoring between raters,
247 resulting in a total training time of 6 hours (42). The review team estimated that rubrics
248 require considerable time e.g. for rater training and for raters to read and mark assignments,
249 and were therefore medium cost. In addition to the six rubrics (Rubrics A to F) described in
250 the higher-scoring studies, 28 different rubrics were described in 32 lower-scoring studies
251 (17, 23, 52-81). Of these only three employed a pretest-posttest design with a rubric to
252 evaluate reflective skills (53, 62, 80).

253 **2. Self-reported scales**

254 Seven of the higher-scoring studies used self-reported scales to measure self-reflective
255 ability, with no additional human judgement required. Although the format used to
256 administer the scale was not always reported (43, 45), some were web-based (35, 38). Each

257 higher-scoring study used one of three self-reported scales namely: Reflection-in-Learning
258 Scale (RiLS) first described by Sobral (43), Self-Reflection and Insight Scale (SRIS) first
259 reported by Grant et al. (82), or Reflective Thinking Questionnaire (RTQ) described by
260 Kember et al. (83). Within the higher-scoring studies all three scales have been reported as
261 being used for pretest-posttest study designs. RiLS was used at the start and end of one 15-
262 week term of an undergraduate medical programme to measure the impact of a voluntary
263 course to teach learning skills (43). SRIS was used to score self-reflection and insight before
264 and after one year of an undergraduate medical programme (45), a course of continued
265 professional education (14) and a six-month programme of case discussion with or without
266 peer assessment (38). RTQ was completed before and after a randomised controlled trial of a
267 smartphone app to document “learning moments” (46). RiLS, SRIS and RTQ comprised 11,
268 20 and 16 items respectively. The review team estimated that the use of these existing self-
269 reported scales is feasible and relatively cheap to undertake in terms of overall resources and
270 are therefore of low cost.

271 Ten other self-reported scales, in addition to RiLS, SRIS and RQT, were used in 43
272 studies to assess self-reflection (43, 82-123). SRIS was the most frequently used self-reported
273 scale. Three other self-reported scales, not including those in the higher-scoring studies, were
274 used as pretest-posttest measures. These were the Groningen Reflective Ability Scale
275 developed by Aukes et al. (89) and used in studies by Aukes et al. (90), Nakamura et al.(109),
276 Duke et al. (112) and van Vliet et al. (123); the Rumination-Reflection Questionnaire
277 developed by Trapnell and Campbell (124) and used by Sutton et al. (115) and the Teaching
278 Reflection Scale developed by Kayapinar and Erkus (125) and used by Armutcu and Yaman
279 (93).

280 **3. Observed behaviour**

281 Two higher-scoring studies described the observation of clinicians-in-training during
282 specific patient encounters, and by an experienced clinician. The assessment instruments were
283 introduced to the users during a group meeting with senior clinicians, described as two hours

284 of departmental time by Roach et al. (47), and as a short briefing by Prescott-Clements et al.
285 (49). The time taken to observe the procedure was not recorded in either case, although the
286 maximum time to complete the online assessment instrument was reported as 3 minutes (47).
287 It was difficult to estimate the cost for observation, as it will depend on the time taken and
288 also the nature of the observation. The review team estimated observation assessment
289 instruments to be high cost compared to other instruments.

290 A further 16 lower-scoring studies described the assessment of self-reflection by
291 observation of the participant (126-141). One study used observation of behaviour in a
292 pretest-posttest design to measure the impact of 11 months of surgical residency training on
293 levels of self-awareness (129). The raters in this study were standardised patients and scores
294 were compared with surgical residents' self-scoring.

295

296 **Discussion**

297 The ability to self-reflect is considered a core skill for all healthcare professionals (1-
298 5), and in an era of outcomes-based healthcare education, where this ability needs to be
299 assessed (6,7), it presents a challenge. The principal aim of this systematic review was to
300 identify the most effective assessment instrument that has been used to measure the ability to
301 self-reflect in adults, in any workplace or educational setting, including healthcare. The broad
302 search strategy, to include any profession that values and assesses self-reflection, was
303 intentional following a scoping search of the literature.

304 Of the 18 higher-scoring studies identified in the review, three types of assessment
305 instrument were subsequently identified, namely: rubrics (or scoring guides), self-reported
306 scales and observed behaviour. These three types of instrument were used within different
307 healthcare training programmes, including dentistry, medicine, nursing, physical therapy and
308 chaplaincy (in healthcare).

309 As part of the review, each instrument was assessed for utility based on the model by
310 van der Vleuten (30), which comprises five criteria: reliability, validity, educational impact,

311 acceptability and cost. This utility model has also been used in other reviews in medical
312 education (142, 143). Two of these criteria, namely reliability and validity, are comprised of
313 more than one component, although they may not be relevant to every type of instrument.
314 Reliability comprises internal consistency (“whether items within a test that are intended to
315 measure the same construct produce consistent scores” (144)), inter-rater reliability and intra-
316 rater reliability. Internal consistency is an important component that should be possessed by
317 all three types of instrument, but was only demonstrated by the three self-reported scales and
318 rubrics A (44) and E (36). Inter-rater and intra-rater reliability are important in the case of
319 rubrics and observed behaviour instruments, but they are not relevant to self-reported scales.
320 Validity comprises content validity (the degree to which elements of an assessment are
321 relevant to and representative of the targeted construct (145)) and construct validity (whether
322 a scale adequately measures the reported construct (146)). Both of these should be possessed
323 by all three types of instrument, but were only reported or implied for each of the self-
324 reported scales and rubrics A, C and E.

325 The higher-scoring studies did not report the educational impact of the instruments
326 and acceptability to the raters was only reported in two studies (39, 49) without reference to
327 other stakeholders such as students or patients.

328 Although costs were not fully described, the review team were able to make an
329 estimate for each type of assessment instrument. This was done by considering the time
330 required by the student to undertake the self-reflection, the assessor to score or rate the
331 student, the requirement for training prior to the use of the instrument, and the setting e.g.
332 clinical or simulated clinical scenario (e.g. video or vignette). Using these criteria, the review
333 team considered the observed behaviour instruments to be the most costly, due to the 1:1
334 nature of the assessment and the fact it was used in a clinical setting. In this case the assessor
335 either participated in the clinical procedure, as occurred with the surgical trainees in theatre
336 (47), or observed the trainee directly without participating in the clinical procedure in the case
337 of recent dental graduates (49). In both instances, the assessor would be required to use some

338 of their own clinical time in observing the student's performance within the clinical setting,
339 adding considerably to costs. With rubrics the greatest costs centred on rater training, the
340 preparation of the materials on which the student had to reflect e.g. clinical cases or vignettes,
341 and scoring the student's assignments, e.g. responses to a clinical simulation, a written
342 assignment or e-portfolio. The review team considered the cost of rubrics to be less than that
343 of the observed behaviour instruments, but greater than that of self-reported scales. Self-
344 reported scales were considered to have the lowest costs because they require the least amount
345 of assessor time during the assessment process, although time would still be required to
346 analyse the results.

347 The most frequently cited instrument within the higher-scoring studies was the self-
348 reported scale, Self-Reflection and Insight Scale (SRIS) (82). It was also one of only five
349 instruments amongst the higher-scoring studies used for pretest-posttest (to assess student
350 performance before and after an intervention or period of study), the others being rubrics A
351 and C, and the other self-reported scales RiLS and RTQ. It is unclear why SRIS was the most
352 frequently cited instrument, but as with the other self-reported scales it may have been due to
353 relatively low cost involved and therefore its suitability for use with large cohorts.

354 Effective self-reflection comprises three elements: an awareness of the need to self-
355 reflect, a willingness to engage with the process (24, 82) and an ability to self-reflect. Within
356 the review it was difficult to determine whether or not each instrument measured all three
357 elements. The first two, an awareness and a willingness to engage, were reportedly measured
358 using the three self-reported scales RiLS (43), SRIS (82), and RTQ (83). Even though a
359 willingness to engage with self-reflection was inferred in all of the higher-scoring studies, it
360 was not always clear whether student participation was voluntary or compulsory. The third
361 element of the process, the ability to self-reflect, was measured in the case of two of the self-
362 reported scales RiLS (43) and RTQ (83), and four of the six rubrics, namely rubrics C (42,
363 50), D (48), E (36) and F (42). It is acknowledged that healthcare professionals find accurate
364 self-assessment challenging (147), and being able to reflect with insight is an important

365 component of reflection. Five of the higher scoring studies used the SRIS scale (14, 35, 37,
366 38, 45), which specifically measures insight. The study by Prescott-Clements et al. (49)
367 included a rating by trainers of the level of insight shown by dental graduates during a
368 feedback session about observations of clinical cases. The measurement of insight was
369 considered a valuable part of the overall process, and so consideration should perhaps be
370 given to its inclusion in instruments designed to assess self-reflection.

371 Triangulation of information from multiple sources with multiple methods has
372 previously been recommended within medical education for the assessment of professional
373 competence (148,149). For the assessment of a complex skill such as self-reflection, it would
374 therefore seem reasonable to apply more than one instrument, or type of instrument to the
375 task. Within the higher-scoring studies only two self-reported scales, RiLS (43) and RTQ
376 (83), purported to measure all three elements of effective self-reflection (awareness,
377 willingness and ability). Although even here it was assumed that participation was voluntary
378 and therefore there was a willingness on the part of the students to participate in self-
379 reflection. This need for triangulation has also been highlighted by Miller-Kulhmann et al.
380 (42) comparing the two rubrics Reflection on Action (Rubric C) and REFLECT (Rubric F).
381 The authors described how the moderate correlation in the scores obtained using the two
382 instruments was better than they had expected, given the fact the two instruments are not only
383 different in form and intention, but have different origins, with Reflection on Action being
384 derived from education and REFLECT derived largely from medicine. However, given that
385 the two instruments were measuring the same construct, they also commented the correlations
386 should have been even greater. Although they suggested the two rubrics were perhaps
387 measuring related and overlapping variations of self-reflective ability, rather than measuring
388 exactly the same ability. A more comprehensive assessment of self-reflection might therefore
389 be gained through triangulation. However, the use of two or more instruments at the same
390 time is not without its problems. The additional costs to the faculty, assessor and student, in
391 terms of both time and money, may not justify the potential benefit if any. Particularly if these

392 are to be used at frequent intervals during an educational programme. An alternative might be
393 to consider using different instruments at different times during a course of study. For
394 example, a self-reported scale might be used during a period of self-study for a large cohort of
395 students, whereas an observed behaviour instrument might be used at the same time as the 1:1
396 assessment of another clinical competence e.g. a Directly Observed Practical Skill (DOPS),
397 mini-CEX or Case-based Discussion (CBD).

398 Another consideration, related to both triangulation and utility, is whether the
399 assessment of self-reflection using any of the identified instruments should be formative or
400 summative. None of the higher-scoring studies described a pass mark or score for any of the
401 instruments above which a participant would be deemed to be sufficiently self-reflective, or
402 below which they might benefit from support, remediation or further reflection. Even
403 following 1:1 feedback, as was the case with the observed behaviour instrument and rubric C
404 (41, 47, 49), it was still not clear if a low score would have educational consequences, such as
405 remediation or re-assessment. The description of an expected passing standard, the route by
406 which the standard is determined, and the consequences for the faculty, assessor and student if
407 the standard is not met, would be useful additions to any future study reporting the use of an
408 instrument to assess the ability to self-reflect. Alternatively, the assessment of reflective skills
409 perhaps requires a more qualitative approach rather than the numeric, quantitative values that
410 are often used for assessment of other competences.

411 The strengths of the review include the representation within the team of three
412 healthcare professions (dentistry, medical education and veterinary medicine) and the
413 expertise of several members in writing systematic reviews (34, 150). In addition, the utility
414 model and subsequent analysis was an important and valuable framework for this review.
415 However, the lack of evidence across all five utility criteria, in particular educational impact,
416 acceptability and cost, is a limitation for educators wishing to make decisions about which
417 instrument would be most appropriate to adopt in their setting. A recommendation as to the
418 most effective instrument is therefore not possible, as there was inadequate information to

419 perform a full utility analysis. The decision to review studies from any profession (not just
420 healthcare) was also a strength. However, the higher-scoring studies were all from healthcare-
421 related professions, which was surprising. It might be argued that selection bias was present
422 as the review team comprised healthcare in education professionals, but we felt this was
423 minimised by the use of pre-determined quality indicators in scoring the studies

424 This study confirmed that self-reflective skills are valued and assessed within a wide
425 variety of professions including healthcare disciplines. A standardised approach to reporting
426 studies using the identified assessment instruments or newly-devised tools, to include the
427 reliability, validity, educational impact, acceptability and cost would facilitate a more
428 comprehensive utility analysis of their effectiveness. Further research is required to identify
429 which instruments are acceptable to all stakeholders in the educational process, for example
430 patients, trainees, clinicians, mentors and tutors. Pretest and posttest study designs, repeated
431 sampling over time and triangulation of scores from different types of assessment instruments
432 would also be helpful in monitoring changes in self-reflective ability in individual healthcare
433 practitioners during training. It might then be possible to provide a threshold score, below
434 which an individual could be offered support to become sufficiently self-reflective.

435

436 **Conclusion**

437 This review identified 3 types of instrument that can be used to assess ability to self-
438 reflect, namely rubrics (scoring guides), self-reported scales and observation of behaviour.
439 Under reporting of the criteria necessary for a full utility analysis meant it was not possible to
440 make recommendations as to the most appropriate instrument(s) to be used to assess this
441 ability. As a result, the use of more than one instrument might be appropriate. Authors of
442 future work should be encouraged to report on the five criteria necessary for comprehensive
443 analysis of utility. It would also be of value to include guidance as to what would constitute a
444 good outcome in the assessment of the ability to self-reflect, and perhaps more importantly

445 what would constitute a poor outcome and the impact this might have on the student and their
446 subsequent training.

447

448

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(* = Higher-scoring papers)

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Appendices

Appendix 1 Definitive additional database search strategies

Appendix 2 Data extraction coding sheet

Table 1 Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Setting	Educational setting Workplace setting for any vocation	
Population	Young adults, adults Undergraduate or postgraduate students	Children \leq 16 years of age Clinical studies with patients as participants in studies of clinical conditions e.g. weight loss, management of diabetes, mental health
Intervention	Instrument for the assessment of self-reflection or self-awareness for example (but not exclusively) scale, tool, measure, questionnaire Studies with self-reported scales that were then given a score by computer or another person	Studies where students were asked directly to describe their own self-reflective ability, unless part of a validated externally scored scale was used Tests of clinical reasoning, personality, cultural awareness or emotional intelligence
Evaluation	Quantitative, qualitative and mixed-methods studies which provide primary data about both the assessment instrument and the participants who were assessed.	Descriptive studies outlining benefits of e.g. a training intervention with no description of an assessment instrument
Limits	In English Published between 1 st January 1975 and 1 st August 2017	Not in English

