

1 **Script concordance approach in nursing education**

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3 **Marie-France DESCHÊNES**, PhD, RN, **Dimitri LÉTOURNEAU**, PhD, RN, **Johanne**

4 **GOUDREAU**, RN, PhD, RN

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6 **Authors's affiliations:** Marie-France Deschênes, Center for Innovation in Nursing Education,

7 Montréal, Canada; Dimitri Létourneau, Assistant Professor, Faculty of Nursing, Université de

8 Montréal, Canada; Johanne Goudeau. Full Professor, Faculty of Nursing, Université de Montréal,

9 Canada.

10

11 **Corresponding** author: Marie-France Deschênes, Center for Innovation in Nursing Education,

12 Université de Montréal, C. P. 6128, succ. Centre-Ville, H3C 3J7 Montréal, Quebec, Canada ([13 \[france.deschenes@umontreal.ca\]\(mailto:france.deschenes@umontreal.ca\)\)](mailto:marie-</p></div><div data-bbox=)

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15 **Abstract**

16 **Background:** Script concordance approach aims at triggering judgments in simulated contexts
17 of uncertainty.

18 **Problem:** Nursing students need to be prepared to manage the uncertainty of clinical practice.

19 **Approach:** The purpose of this manuscript is to describe the theoretical foundation and the
20 pedagogical use of the script concordance approach as well as to present the current state of
21 nursing evidence on the subject. The script concordance approach includes: 1) script
22 concordance testing, which is a quantitative exam to evaluate clinical reasoning; 2) a face-to-face
23 script concordance activity; and 3) a digital educational strategy based on script concordance
24 delivered via an online teaching/learning platform that aims to support clinical reasoning's
25 development.

26 **Conclusions:** Relying on questioning and experts' modelling, the script concordance offers an
27 innovative pedagogical approach that approximates the uncertainty of clinical practice.

28 **Keywords:** clinical reasoning, decision-making, nursing education, script concordance,
29 uncertainty

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33 Clinical reasoning (CR) is a competency characterized by the recursive metacognitive
34 and cognitive processes deployed by the nurse when facing a clinical situation.¹ These processes
35 make it possible to give meaning to clinical data, to make clinical decisions and to establish an
36 appropriate course of actions.^{2,3} However, the decisions to be made in most clinical situations are
37 not readily apparent, suggesting that uncertainty is present in nursing practice.⁴ Uncertainty
38 arises when there is insufficient information in a given situation^{4,5}, thus preventing the

39 confirmation of clinical nursing hypotheses. Reflecting a dynamic state of self-reassessment of
40 CR processes by nurses, uncertainty also implies that more than one hypothesis must be
41 considered regarding a situation and that a doubt can always remain, despite the presence of
42 evidence or conclusive information.⁶

43 The complexity of nursing practice requires a development of CR in newly graduated
44 nurses that is sustained long enough for them to practice safely.¹ An insufficiently developed CR
45 potentiates the risks of adverse incidents or errors, which, in turn, can threaten patient safety and
46 quality of care.^{2,7} Although challenging, it is important for nurse educators to prepare
47 prelicensure nursing students so that as new graduates they are able to clinically reason in the
48 context of uncertainty. While a growing number of educational strategies could promote the
49 development of nursing students' CR, those that address the uncertainty of clinical practice are
50 rare.⁵

51 One innovative strategy is using the script concordance approach.^{8,9} This approach allows
52 the development of CR of learners through judgments in simulated contexts of uncertainty.
53 Learners can then compare their judgments to those of experts in the field. The script
54 concordance approach includes: 1) script concordance testing (SCT), which is a quantitative
55 exam to evaluate CR; 2) a face-to-face script concordance activity; and 3) a digital educational
56 strategy based on script concordance (DESBSC) delivered via an online teaching/learning
57 platform. The purpose of this article is to describe the theoretical foundation of the script
58 concordance approach, present the pedagogical use of the script concordance approach (SCT,
59 face-to-face or DESBSC) in nursing education, and summarize the current state of evidence in
60 nursing on the topic.

61 **Theoretical Foundation**

62 The 2 main theoretical underpinnings of SCT and DESBSC are script theory^{10,11} and
63 cognitive companionship.^{12,13}

64 *Script Theory*

65 The integration and precise organization of a body of knowledge accumulated over the
66 years is the foundation for the consolidation of the nurses' CR.^{1,3,14} Expert nurses have acquired
67 a broad repertoire of professional situations that guides and regulates their practice, supported by
68 the efficient use of their contextualized knowledge in action.^{1,3} Throughout their practice, these
69 experts developed rich networks of knowledge, called scripts, to address clinical situations.¹⁵
70 Scripts are the "fuel" of CR, containing associative links between data.¹⁶ The activation of the
71 script quickly gives access to significant key elements of the data identified in a clinical
72 situation.^{16,17} For instance, such data could be the situation's characteristics that appeared salient
73 to the expert. This recognition of the salient elements in a clinical situation allows the expert to
74 assess whether the current situation bears the same signature as that of its usual representation
75 that is encoded in the scripts.^{17,18} This search for alignment between the current situation and the
76 scripts involves an active processing of the data that leads to the development of several
77 hypotheses. The expert must then choose the hypothesis that is the most plausible in the context
78 of the clinical situation.^{17,18}

79 *Cognitive Companionship*

80 Cognitive companionship is defined as the creation of an optimal learning environment
81 based on social interaction for learning.^{12,13} The principles of cognitive companionship stipulate
82 that offering a cognitive support adapted to the learners' level (scaffolding), as well as providing
83 explicit teaching moments combining questioning, modelling, supervision, and feedback, are
84 essential to the development of complex competencies.^{12,13} Cognitive companionship also

85 comprises the learner's articulation of knowledge in addition to a reflection on action.
86 Articulation means helping learners to express their thought processes through different
87 strategies, for instance the think aloud method (TA).¹⁹ Reflection on action allows learners to
88 compare their own CR processes with those of experts, highlighting similarities and differences,
89 as expected to foster the competency's development.^{12,13} In the concordance approach, as
90 cognitive apprentices, learners practice judgments which are compared with those of experts. As
91 cognitive companions, experts make their judgments more visible, allowing the learners to model
92 experts' cognitive processes.²⁰ The use of uncertain situations illustrates the scaffolding principle
93 of cognitive companionship where the learners are gradually challenged and can learn from
94 experts' feedback.⁸

95 **Script Concordance testing**

96 SCT is a case-based written examination involving the use of ambiguous and uncertain
97 simulated situations in a vignette. The learners are required to present their judgments about the
98 proposed nursing hypotheses or interventions. A SCT typically includes about 20-30 vignettes
99 (60-90 questions) that mirror clinical situations as authentically as possible. These ambiguous
100 situations, which should be frequent in nursing practice, introduce issues pertaining to patient
101 safety where learners can assess resulting health consequences.²¹ Usually the situations are brief,
102 100 words or less; furthermore, they should pertain to ill-defined problems, to incompleteness,
103 complexity, and ambiguity. Moreover, each proposed hypothesis must be plausible and relevant
104 to the simulated situation, representing potential experts' suggestions. The authors'
105 recommendations are to include 3 to 4 proposed hypotheses per situation, as experts would
106 generate.^{11,21} Following this proposition of hypotheses is the addition of a new information about
107 the clinical situation, an information that would be sought by experts to validate or invalidate to

108 these hypotheses. This additional information may take various forms: findings of a physical or
109 mental assessment, new signs or symptoms, or verbalizations or perceptions expressed by the
110 patient or family members.

111 As for the judgment that comes after the addition of information, a Likert scale is used
112 and is adapted to the developmental level of the learners.⁹ For instance, the present authors
113 suggest using a 3-anchor Likert scale (hypothesis reinforced, neither reinforced nor minimized,
114 or hypothesis minimized) for prelicensure students. When learners' competency reaches a higher
115 developmental stage as expected as senior level nursing students, a 5-anchor Likert scale can be
116 used, because these learners can refer to a larger repertoire of organized and structured
117 knowledge (ie, scripts). The Figure presents an example of a nursing simulated vignette in a
118 SCT. Before being used with learners, vignettes are answered by a panel of experts without
119 seeking consensual responses.²¹ In other words, experts answer individually without consulting
120 references (eg, textbooks) or peers. The goal is to obtain experts' tacit knowledge, the salient
121 elements they identify in a situation to make judgments.

122 To make a judgment, learners need to activate and mobilize their available scripts.²¹ The
123 learners' judgments are compared to those of a panel of experts who previously responded to the
124 same vignettes, highlighting the notion of concordance. Literature reviews have reported that
125 SCT allows quantitative assessment of CR by using experts-based aggregate scoring.²¹⁻²³ In
126 short, if the response given by the learner is the one that the majority of experts has chosen (ie,
127 the modal response made by the experts), the learner gets one point (full credit). The learner gets
128 a partial point if learner's response concords with at least one of the experts. Finally, no point is
129 given if none of the experts have chosen the learner's answer.²¹

130 **Digital Educational Strategy based on Scripts Concordance**

131 DESBSC is an online educational strategy that includes a digitized SCT with
132 incorporated experts' feedback.⁹ The educational strategy typically includes approximately 10
133 vignettes for an asynchronous activity lasting 60-90 minutes.²⁴ Prior to the educational strategy's
134 use with learners, experts answer the questions for each vignette, and they add written comments
135 to justify their answers.^{8,9,24} These comments added to the SCT serve as feedback. Three to five
136 experts from the academic or the clinical settings constitute a panel of experts.⁹ Because this is
137 an online strategy, the learner benefits from automated feedback that presents the experts'
138 reasoning process that leads to their decisions (see Supplemental Digital Content, Figure). The
139 first feedback is the expert's judgment, while the second feedback presents their explanations. A
140 third type of feedback is intended to point to a key message for one or a set of vignettes and to
141 provide references and resources to the learners that they may consult.^{8,24}

142 When completing a DESBSC, the learners validate whether their choices are coherent
143 with the ones of experts. Credible experts are selected from clinical or academic settings. In this
144 perspective, it is suggested to reveal the identity of the experts to the learners as a means to
145 reinforce the perceived credibility and demonstrate the professional diversity among the panel.
146 This can be implemented by displaying the profiles of the experts on the learning management
147 system, while keeping their individual answers anonymous. As previously mentioned, the
148 feedback in a DESBCS is automated and complemented by key elements and hyperlinks to other
149 educational resources.^{8,9,24} Nurse educators designing a DESBSC elaborate these key elements,
150 which may include online resources, articles, or other materials that could be useful to the
151 learners' understanding and relevant to the simulated situations. In summary, the DESBSC aims
152 to explicit the tacit knowledge of experts in simulated situations. This educational strategy may

153 raise the learners' awareness about the diversity of possible relevant interventions used to solve a
154 situation, within a context of uncertainty where grey areas and subtleties remain.^{8,9}

155 **Pedagogical Use of Script Concordance Approach**

156 Nurse educators could use 5-10 vignettes of a SCT to provide a formative assessment of
157 learners' CR in a specific area of nursing (eg, pediatrics, emergency care, gerontology, etc.).
158 Tedesco-Schneck²⁵ tested an educational practice combining SCT questions and a TA method in
159 a pediatric nursing course. Following the completion of the SCT questions, a classroom
160 workshop was conducted to stimulate the students' TA cognitive processes. Students had to state
161 aloud their judgments and the rationale behind their judgment for some of the SCT questions.
162 The author emphasizes the contribution of this face-to-face concordance activity in facilitating
163 the understanding of CR processes and in clarifying erroneous CR. Peer discussion and the
164 sharing of different perspectives helped students to better grasp the complexity of CR.²⁵ SCT
165 questions combined with the TA method could help expand the learner's repertoire of knowledge
166 and its organization (scripts) and thus facilitate the development of CR.^{25,26}

167 Nurse educators are also encouraged to make their scripts more visible to allow learners
168 to gradually model the experts' cognitive strategies and mobilized knowledge in a clinical
169 situation. E-learning environments allow for automated formative feedback instead of or in
170 addition to a concordance score in a DESBCS. This is a form of asynchronous cognitive
171 companionship because it solicits the learner's articulation of knowledge through judgments,
172 which then results in the learners' reflection comparing their own judgments to those of the
173 experts. DESBCS can also be conducted in a synchronous mode to optimize interactivity in the
174 classroom by querying, collecting, and counting learners' responses while instantaneously
175 presenting results obtained previously from experts in the field. In this sense, it could create a

176 formative synchronous dialogue between learners and the nurse educator to reinforce key
177 elements or to initiate a discussion when experts' responses are varied or even divergent.⁹

178 **Current State of Evidence on Script Concordance Approach**

179 In nursing, studies mostly focus on the development of SCTs¹⁵, on the understanding of
180 the hypothesis processes by the combined use of SCT and the TA method²⁶, and on the
181 cognitive strategies mobilized by undergraduate nursing students, new graduate nurses, and
182 experts nurses.¹ Other publications in nursing education have used SCT to evaluate the
183 effectiveness of a serious game²⁷ or immersive simulation²⁸ to evaluate CR, measured by a SCT.

184 Recent research in medical education inquired the possible threats to the validity and
185 fidelity of the SCT²⁹, precisely on the response process of experts and learners in such uncertain
186 situations. For instance, responses can be chosen arbitrarily, or based on misinterpretation of the
187 SCT questions.^{30,31} Power et al³¹ associated the SCT response choices with written justification
188 of paediatric post graduated trainees' thought processes. Results showed that there was
189 sometimes a discrepancy between the concordance score and trainees' reasoning. For example,
190 trainees held incorrect rationales for correct SCT response choices or interpreted SCT questions
191 in an unexpected way. Similarly, Gawad et al³⁰ explored the cognitive process of test-takers
192 (surgeons and residents) when using SCT questions. A cognitive interview followed the
193 completeness of the SCT. Results revealed issues with the SCT questions. Responses of trainees
194 were influenced by their comprehension of specific terms, their needs for additional information
195 or their disagreement with the proposed hypothesis. The authors recommend having test takers
196 verbalize their rationale to optimize learning and to provide a broader assessment of CR that is
197 otherwise lost in the current format of SCT questions.

198 Issues related to the measure of CR by the SCT do not limit its pedagogical use to trigger
199 judgments in simulated contexts of uncertainty. Recent research has investigated the students'
200 learning strategies while participating to a DESBSC⁸ and its perceived acceptability and
201 usability.²⁴ By completing a DESBSC, learners were brought to mobilize their nascent scripts,
202 reason, make choices (judgments), and revisit them with the feedback provided by the experts.
203 Additionally, DESBSC engaged the learners in a reflective process and may advance their
204 learning with the experts' feedback.⁸ Learners appreciated the educational strategy, especially
205 the various and formative feedback of experts to uncertain situations related to professional life.
206 Forthcoming research could explore both new scoring modalities that would represent a more
207 reliable measure of CR by the SCT and the impact of the script concordance approach on the
208 development of nursing students' and nurses' CR.

209 **Conclusion**

210 Nurses' decision in most clinical situations are not readily apparent and they suggest the
211 presence of uncertainty. Developing students' CR could not be more relevant in this context and
212 the script concordance approach appears as a relevant innovation in nursing education that needs
213 to be further explored. This approach entails the development of learners' CR by judgments
214 involved in simulated contexts of uncertainty that are then compared to those of experts in the
215 field. Key elements are also provided to guide the learners' judgments.

216 While the SCT is part of a quantitative measure of CR, the face-to-face concordance
217 activity and the DESBSC support the development of this competency using the feedback from
218 experts. Such a learning device will only be of interest if it offers learners complex problems
219 where solutions are not standardized. Being at its infancy in nursing education, the script
220 concordance offers a novel pedagogical approach to support the development of CR early in the

221 curricula while also providing a promising tool that approximates the uncertainty of clinical
222 practice. This approach could also promote academic progression of graduates in furthering
223 education.

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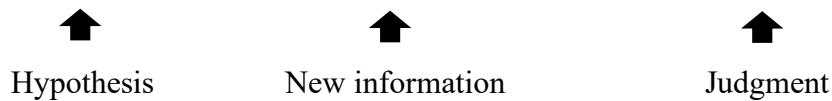
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320

Mr. Buisson, 38 years old, had a cholecystectomy. He received antalgic medication since his return from the recovery room. You notice that the patient requires physical stimulation to keep him awake and that his breathing seems labored, like a snore, with a respiratory rate of 10 breaths/min.

If you were thinking to....	And then ...	The new information makes the hypothesis:
... initiate oxygen therapy for $\geq 95\%$ $S_{p}O_2$... you observe the presence of rhonchi at pulmonary auscultation	<input type="checkbox"/> : strongly reinforced <input type="checkbox"/> : reinforced <input type="checkbox"/> : neither reinforced nor minimized <input type="checkbox"/> : minimized <input type="checkbox"/> : strongly minimized
... notify the doctor of Mr. Buisson's condition	... you notice the following results of a venous blood gas: pH: 7,25 PCO ₂ : 52 mmHg HCO ₃ ⁻ : 12 mEq/L	<input type="checkbox"/> : strongly reinforced <input type="checkbox"/> : reinforced <input type="checkbox"/> : neither reinforced nor minimized <input type="checkbox"/> : minimized <input type="checkbox"/> : strongly minimized
... ask the respiratory therapist to assess Mr. Buisson's condition as soon as possible	... you notice that Mr. Buisson suffers from sleep apnea	<input type="checkbox"/> : strongly reinforced <input type="checkbox"/> : reinforced <input type="checkbox"/> : neither reinforced nor minimized <input type="checkbox"/> : minimized <input type="checkbox"/> : strongly minimized

321



322

Figure. SCT

323

324 Ms. Jordan, 84 years old, has had Alzheimer's disease for more than 10 years, making interactions
 325 very difficult. You start a meeting with Ms. Jordan's children: Nancy and Leo. At the beginning
 326 of the meeting, Nancy reminds you that she lives with her mother. She deliberately shows her
 327 distress about this situation and tells you that she feels exhausted.

328

If you were thinking to ...	And then, you find ...	The new information makes the hypothesis ...
... explore with Nancy and Leo what would be the best way to help them immediately.	... unlike his sister, Leo believe that is better to move their mother in a nursing home.	<input type="checkbox"/> : strongly reinforced <input checked="" type="checkbox"/> : reinforced 2 <input type="checkbox"/> : neither reinforced nor minimized 2 <input type="checkbox"/> : minimized <input type="checkbox"/> : strongly minimized

Reinforce

Expert 1 - Caregivers are at risk of distress and the use of existing resources is likely to decrease this distress. Thus, discussing resources with the patient's children and these resources can support them in the care they provide to their mother may be relevant.

Expert 3 - Systemic family interventions can help clarify each child's beliefs and expose their unique situation in a way that promotes dialogue and a common goal.

Neither reinforced nor minimized

Expert 2 - Before offering services to Nancy, it is important to evaluate her beliefs about taking care of her mother alone. As long as this belief is sustained, the resource proposal will not reflect Nancy's needs.

Expert 4 - It will also be important to explore Leo's beliefs and needs. By doing so, Nancy and Leo can better understand their respective wishes. It is important to avoid imposing the professional's solution on the family. It is therefore crucial to be interested in the experience of the patient's children and their feelings. This assessment may help the nurses to better understand their respective responses to the patient's preferred living environment.

Synthesis

Knowing how to approach the issue of helping caregivers makes all the difference. Having an attitude of non-judgment and empathy, supporting free and informed decision-making, showing curiosity to know their reality, these are examples of behaviors and attitudes that make it possible to create the bond of trust in order to be able to discuss in an authentic way.

Here are some resources to consult ...

329

Figure. Experts' feedback and synthesis