Cognitive Apprenticeship Learning in Paediatric Clinical Settings

Karen Markussen Linnet*,1, Lise Bols Andersen2 and Thomas Balslev2,3

1Department of Paediatrics, Aarhus University Hospital, Denmark
2Department of Paediatrics, Viborg Regional Hospital, Denmark
3MEDU, Centre of Postgraduate Medical Education, Aarhus University, Denmark

Abstract: Objectives: Cognitive apprenticeship learning focuses on improving understanding and clinical diagnostic reasoning among learners. The aim of this study was to describe the feasibility of cognitive apprenticeship encounters in clinical paediatric settings in terms of time consumption; and to describe the encounters in terms of learner and teacher behavior.

Methods: This study was based on data from 485 self-reports filled in by participating learners during a 3-month quality improvement project conducted at three Danish paediatric departments. Teacher and learner cognitive apprenticeship skills training took place at repeated workshops. A total of 59 different learners participated, 4 were medical students, 49 were residents, and 6 were specialists in pediatrics. A total of 75 different teachers participated.

Results: Apprenticeship encounters between teachers and learners lasted median 9 (range 2-120) minutes. In 47% of the encounters, the teacher and learner examined the child together. In 91% of the encounters, the learner reported that his or her knowledge was challenged and in 92% of the encounters, the learners and the teachers verbalized their clinical diagnostic reasoning processes. Educational strategies to reach learning objectives were reported in 77%.

Conclusions: Cognitive apprenticeship learning was a feasible approach to teaching and learning in paediatric departments. Median 9 (range 2-120) minutes were used for the encounters. Almost all learners reported being challenged during the encounter. Almost half of the encounters included a joint teacher and learner examination of a patient.

Keywords: Apprenticeship, educational strategies, pediatrics.

BACKGROUND

Learning often occurs through collaboration with other team members [1-3]. An example is when medical students and residents work together with experienced staff physicians in a clinical setting. Interaction with more experienced clinicians is important for learners to understand the background for clinical activities [4]. Research now provides knowledge about activities that may promote constructive learning in the workplace: opportunities to elaborate and make thinking visible, i.e. externalize and concretize one’s own clinical diagnostic reasoning processes [5,6].

One way to promote clinical diagnostic reasoning is to practice cognitive apprenticeship training where residents articulate their thoughts and compare own knowledge and skills with those of an expert [7,8]. Among known strategies in cognitive apprenticeship learning are going to the bedside, examination room, outpatient clinic or using the medical record asking for and modeling summary statements [7,8].

Cognitive apprenticeship differs from traditional apprenticeship by extending generalized knowledge to be used in different settings, whereas traditional apprenticeship emphasizes teaching skills in the specific context of their use [7,8]. The updated concept of apprenticeship “cognitive apprenticeship” emphasizes, that the focus is on cognitive skills and processes, rather than physical ones [7,8].

There are six teaching models associated with cognitive apprenticeship [7,8]. The first three teaching models are modeling, coaching and scaffolding [7,8]. However, these models are also the core principles in traditional apprenticeship. The teacher is a model, the teacher observes and facilitates the learners’ task and the teacher provides support to help the learner perform a task. The next two methods are articulation and reflection [7,8]. The teacher encourages the learners to verbalize their knowledge and thinking, and teacher and learner compare their performance with each other. These two models help the learner to focus observations and problem solving strategies. The final method is exploration, which encourages the learner to solve their problems by themselves, i.e. self-directed learning [7,8].

Apprenticeship training based on authentic cases is often hampered by patients’ decreased length of stay in hospital, reduced hours or heavy service demands [2]. Information about time required for authentic cognitive apprenticeship situations in clinical practice is sparse. Other aspects of apprenticeship training such as learning outcome and learner and teacher behaviour have rarely been measured in authentic clinical teaching environments [7]. The results of a study by Stalmeijer et al., suggest that cognitive apprenticeship is a useful model for teaching and learning for medical students in clerkships. The results suggest that teacher’s lack of time and formal training were the main barriers to cognitive ap-
prenticeship learning [9]. Likewise, time limitations to bed-
side teaching in pediatrics have been identified by others
[10].

Thus, this study investigated the time consumption of
cognitive apprenticeship learning encounters. Moreover, this
study documented the frequency of joint examination of a
patient; frequency of learner's perception of having their
knowledge challenged during the encounter and frequency of
verbalization of the clinical reasoning process.

MATERIALS AND METHODOLOGY

Study Setting

This prevalence study was based on data from a 3-month
quality improvement project designed to support cognitive
apprenticeship teaching and learning in clinical paediatric
settings. The quality improvement project included an intro-
ductory workshop in each of three Danish paediatric depart-
ments at Aarhus University Hospital, Skejby, Viborg Re-
gional Hospital and Herning Regional Hospital. In each
workshop, 20-35 medical students, residents and faculty par-
ticipated. By use of illustrative examples, the methods of
cognitive apprenticeship: modeling, coaching, scaffolding,
articulation, reflection and exploration were briefly intro-
duced by the workshop facilitator (TB) [7,8]. Subsequently
the methods were practiced in small groups comprising one
or two learners and a senior physician simulating cognitive
apprenticeship teaching and learning during analysis of two
to three authentic patient video cases each lasting 30-60 sec-
onds [6]. After small-group discussion of each patient video
case, each participant volunteered for the whole group the
methods as they had been applied; and the workshop facilita-
tor aided a discussion of the advantages and disadvantages of
the different methods.

To maximize transfer of cognitive apprentice methods to
clinical practice each workshop was concluded by partici-
pants identifying optional situations in their department suit-
able for cognitive apprenticeship encounters. In this way the
methods of cognitive apprenticeship teaching methods and
their relevance were explicit and brought into the open for
teachers as well as learners. After the project period, con-
cluding workshops with debriefing and additional simulated
apprenticeship training took place at each department. Meth-
ods of cognitive apprenticeship were practiced once more.
The duration of workshops was 1.5-2 hours.

Target Population

All specialists, residents and medical students in clerk-
ship rotations (4 weeks) were invited to participate.

Data Collection

Immediately after each encounter, learners filled in a 10
item self-report card concerning the encounter and the cog-
nitive processes (Table 1). The learners reported the time spent
during the encounter, whether verbalization of clinical rea-
soning by teacher and learner occurred, whether joint exami-
nation of the patient occurred, and whether they felt their
knowledge had been challenged. The learner also reported
the topic of the encounter, learning outcomes and their plans
to learn more. Informed consent was obtained from the study
participants at the time they filled in the self-report cart.

ANALYSIS

Data from all self-report cards from the project was tran-
scribed into and analyzed using Excel. Measures of the time
spent during the encounter were missing in 13 self-report
cards. The median time spent on apprenticeship training was
therefore calculated from results from 472 (97%) self-report
cards. The response rate and positive answers for the remain-
ning questions from the self report cards were calculated and
reported in percentages (Table 1), These results are based on
the total study group (n =485).

RESULTS

A total of 485 self-report cards were completed. A total
of 59 different learners participated, 4 were medical students,
49 were residents, and 6 were specialists in pediatrics. A
total of 75 different teachers participated.

The median time spent on apprenticeship training was 9
minutes (range: 2-120 minutes); (n= 472; 97%). In 92% (n =
485) of the encounters the learners and the teachers verbal-
ized their clinical diagnostic reasoning processes. In 47% of
the encounters the learner and teacher examined the child
together. In 91% of the encounters, the learners reported that
their knowledge had been challenged.

Table 2 shows examples of the topics of the encounters
and the associated clinical reasoning processes. In 77% of
the encounters the learners reported specific learning objec-
tives to be pursued, in textbooks or in clinical guidelines
(40%), by internet-search (8%), by training in the daily clini-
ical practice (23%), or by patient follow-up (16%). When
outcome measures were calculated for each department sepa-
ately, the results were similar.

DISCUSSION

In the majority of the encounters, bilateral articulation of
clinical diagnostic reasoning occurred. It is important to note
that this very desirable outcome [3] occurred in median 9
minutes. In almost half of the encounters, a patient was ex-
amined jointly by teacher and learner, illustrating the high
authenticity of cognitive apprenticeship encounters. Fur-
thermore, most of the learners reported plans to explore
more, i.e. self-directed learning [8]. This means that learning
may continue following the encounter [8]. To the authors'knowledge, this is the first report of time expenditure of
cognitive apprenticeship encounters from a clinical setting.

The major purpose of this quality improvement project
was to support apprenticeship learning in clinical paediatric
practice. Using the self-reported cards, we were able to em-
pirically test which specific strategies were used by the
learner and teacher, respectively and to describe aspects of
professional performance during cognitive apprenticeship
encounters [2,11]. Almost all participants verbalized their
clinical reasoning processes and almost all learners felt that
they had been challenged. This suggests that the encounters
were indeed cognitive apprenticeship encounters. The docu-
mented frequency of the encounters suggests that cognitive
apprenticeship encounters can be accomplished, and are fea-
sible for teaching and learning in clinical settings. The
authenticity is further underlined by almost half of the situ-
ations involving mutual examination of a patient.
Table 1.  **Self-Report Card**
Response rate for each item are given in italics. Illustrative sample responses by one resident are given. This card was filled in by the apprentice who had a dialogue with a more experienced colleague and reflected on his or her knowledge and skills.

<table>
<thead>
<tr>
<th>Hospital, department</th>
<th>Date</th>
<th>Time used</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viborg Regional Hospital</td>
<td></td>
<td>10 minutes</td>
<td>97%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Please answer yes or no</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I explained my findings or thoughts</td>
<td>x</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>The teacher explained his clinical reasoning (think aloud)</td>
<td>x</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>We examined a patient together</td>
<td>x</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>I felt my knowledge and skills were challenged</td>
<td>x</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Please describe the focus of your dialogue</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A small child was admitted with fever. The child was evaluated for a urinary tract infection. A bladder puncture was performed, to test for infection.</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Please describe your clinical reasoning</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>My first bladder puncture.</td>
<td>95%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Did you learn during the dialogue?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, - the technique for bladder ultrasound scan evaluation, bladder puncture, and the indications for the procedures.</td>
<td>97%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What do you plan to do to learn more?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Present the case to my colleagues at the morning conference.</td>
<td>80%</td>
</tr>
</tbody>
</table>

Name and signature of apprentice

Name of Teacher

Table 2.  **Examples of the Learner’s Reported Clinical Diagnostic Reasoning Processes**

<table>
<thead>
<tr>
<th>Topics of encounter</th>
<th>What I thought</th>
<th>What I learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>A child with fever and cerebral irritability.</td>
<td>Meningitis?</td>
<td>Lumbar puncture has to be performed. Assessment of cerebral status in children.</td>
</tr>
<tr>
<td>Asthma in a four-year-old.</td>
<td>How to decide to treat or not?</td>
<td>Planning of home measurement of asthma symptoms and peak flow.</td>
</tr>
<tr>
<td>Management of a dehydrated child.</td>
<td>Type of dehydration?</td>
<td>I learned about different kinds of intravenous liquid therapy.</td>
</tr>
</tbody>
</table>

It is a strength of this study that experiences from several departments are reported. The results suggest that cognitive apprenticeship teaching and learning is feasible in a variety of clinical settings. Shortcomings of this study are the reliance on a self-report measure, and the extra attention that accompanied the quality improvement project. Both may have inflated the results. On the other hand, it is our clear impression that several encounters with cognitive apprenticeship occurred during the quality improvement project period without filling in of a self-report card. This means that the frequency of encounters is probably underestimated.

It is worth noting, that we have no measures of the prevalence of apprenticeship encounters prior to or after the study period. Likewise, in this study we did not attempt to assess learning outcomes or changes to practice following cognitive apprenticeship encounters. Thus, it cannot be concluded whether the quality improvement project or this study resulted in improved cognitive apprenticeship learning, let alone changes to practice.

**CONCLUSION**

This study suggests that cognitive apprenticeship learning in clinical practice is feasible with a median time expen-
duration of 9 minutes (range 2-120). The quality of the encounters is reflected by almost all learners reported being challenged during the encounter, and the authenticity is shown by almost half of the encounters including a joint examination of a patient.

CONFLICT OF INTEREST

None declared.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the contribution of staff and students at the paediatric departments at Aarhus University Hospital, Skejby, Viborg Regional Hospital and Herning Regional Hospital, without whose cooperation this study would not have been possible. This work was partly funded by The Quality Development Foundation for Education of Residents, Aarhus Denmark.

REFERENCES


