

Dental Student Perceptions of Learning in Dyad Practice - A Qualitative Study

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Abstract

Introduction: The medical education literature has shown positive student performance with and attitudes towards dyad clinical practice. There is a paucity of literature about dental student dyad practices. Present study describes experiences and perceptions about dyad practice at a teaching clinic in Denmark.

Methods: Qualitative Description methods were used to reveal clinical dyad learning phenomena based on semi-structured interviews. A purposeful sampling strategy focused on recruiting experienced informants, that is, eight final-year clinical dental students. They were asked to describe overall assessments, advantages, disadvantages, teaching styles and improvement suggestions for dyad learning. In content analyses, interview descriptions were coded in categories. Codings were summarized and patterns were identified using NVivo software. Findings were condensed in a short follow-up questionnaire for the same informants for validation of interview findings and estimates of informant agreement.

Results: Informants described overall assessment as positive with the main qualifying condition that dyad learning was best for less experienced clinical students. Main benefits found were 1) support for remembering theory and procedures at chairside, 2) learning by sharing mistakes and successes, 3) built-in quality control, 4) optimized teacher time and 5) a safe learning environment that allayed stress and promoted self-confidence. Main disadvantages were less hands-on chair time and lack of experience with learning to operate independently. Informants described success in dyad practice as learning to communicate needs and expectations in order to avoid conflicts. Informants described best teacher practices as striving to activate both partners in the dyad. Suggestions for optimizing dyad learning: 1) dyads in less available treatment types, 2) less dyad time in later years and 3) partner reassignments in later years. Informants exhibited high internal consistency ($\alpha = .97$) at follow-up.

Conclusion: Informants described that dyad practice tended to promote student self-efficacy, possibly reducing the stress of notoriously highly stressed dental students. It also appears to provide a good model for improving educational efficiency, especially in early clinical years, and for more difficult, complicated or less frequently encountered treatments.

Keywords: Dyad practice, dyad learning, clinical education, dental students, medical students, stress perceptions

INTRODUCTION

Peer-assisted learning (PAL) has been explored as a student activating motivational strategy over the last 20 years.^{1, 2} PAL is a valuable adjunct to conventional teaching methods, especially in multiple student to teacher clinical environments.

The term PAL in the literature encompasses a range of activities, including peer tutoring or mentoring or teaching, peer observation, peer feedback and peer assessment. The most commonly cited definition of PAL (Table 1) is people who are not professional teachers, helping each other and in doing so, improve their own learning.³

Table 1. Descriptions of terminology used in this article

| TERM | Description |
|-------------------------------------|--|
| Peer-assisted learning (PAL) | Learning in which people from similar social groupings, who are not professional teachers, are helping each other to learn and by so doing, are learning themselves. Topping & Ehly ³ |
| Dyad learning | A subtype of reciprocal PAL in which pairs of same level students share learning responsibilities including what an operator, non-operator or both are learning. |
| Dyad practice | The practice of working in pairs of clinical dental students who share chair time and switch between roles of operator and non-operator for different patients or treatments. |
| Operator | The dental student in the dyad who is mainly responsible for organizing the treatment plan and primarily executes a patient's treatments. The operator is usually the patient's officially assigned dental student in the teaching clinic. |
| Non-operator | The dental student in the dyad who has the role of learning partner, dental assistant and PAL helper to the operator. |
| Cultural consensus theory | Based on a mathematical model, the pattern of agreement or consensus among informants is used to make inferences about their knowledge of answers to questions about phenomena in their group culture. |

Present study is focused on the process of learning in a specific type of PAL in which two students of the same academic level are paired in a clinical situation as a reciprocal learning dyad (Table 1). Reciprocal dyad practice at same class level is commonly used with medical students^{1, 2, 4-9} and has even been shown in some instances to be more effective and educational for beginning clinical students compared to traditional individual instruction.^{5, 6} Unlike the clinical medical student literature, there is a paucity of literature about clinical dental student same level reciprocal dyad learning practices.^{10, 11} One survey of 186 British dental students¹⁰ found that most enjoyed working in pairs, citing mutual support and collaborative learning as main advantages. However, most of the students did not understand the rationale for the program and appeared to have had misgivings about it. In another survey study, 148 Malaysian clinical students¹¹ perceived the main advantage to be better quality control of procedures and products. However, authors were concerned that since the program had been forced on the students, it affected their willingness to accept it and may have induced bias in their results. They suggested in future studies to survey cohorts that had started out in dyad practice. Since both research groups used survey methods, neither of these studies used research methods to elicit students' own

perceived understanding of learning phenomena in dyad practices.

Therefore, the overall purpose of this study was to get a better understanding of dyad practice specific to dynamics of reciprocal dyad learning among clinical dental students using qualitative description methods. The hope was to contribute to the literature and to informed educational policy.

Specific aims were to explore perceptions of dental students regarding 1) overall assessment of clinical learning in dyad practice, 2) specific learning advantages, 3) specific learning disadvantages, 4) assessment of teacher styles or strategies and 5) suggestions for improvement of dyad learning.

MATERIALS AND METHODS

Setting

In September 2014, dyad practice was formally initiated for all clinical students at the Aarhus Dental School's teaching clinic. This was done with a hope to increase effectiveness and efficiency of clinical learning. However, since it was introduced as part of a university economic austerity program, it had a difficult start and appeared to many that it would result in reduced hands-on treatment time for each individual student. There were concerns and political

controversies¹² about whether students would therefore become independent and competent enough in their clinical work by graduation. Dyad practice currently represents approximately 75% of the Aarhus students' 3-year clinical program from start to finish. Students from the first clinical year were placed in dyads 100% of their clinical teaching time, second clinical year about 75% and third year students about 50%.^{13,14} Overall clinic time for students was expected to increase by about 7%.¹³ Minimum production requirements for clinical work were not changed.

By 2016, administrative reports about dyad practice lauded increased learning, greater feelings of security, practical support and less stress, especially among first year clinical students.^{13,14} Students were described as happy to have a confidential learning partner when in doubt.^{13,14} These reports were similar to results of studies on medical students showing that dyad practice was especially advantageous in initial clinical learning dyads and provided a "shared memory bank" that was reassuring to dyad partners regarding theory and steps in clinical treatment.^{15,16} A higher level of self-confidence and peace of mind were also seen among the dyad pairs in clinical medical students compared with individual practice or simulation learning.^{5-7,16} Tolsgaard et al.,⁵ showed that dyad learning and individual self-regulated learning were equally effective, even though the individuals in dyad pairs had only half the hands-on practice time.

Since the two Aarhus administrative reports did not provide in-depth details about student or teacher perceptions of the new dyad practice policy, another aim of the present study was to use qualitative methods to gain nuanced insights into same-year reciprocal dyad practice phenomena.

Table 2. Interview questions

8 student subjects:

- 1) What do you think overall about working in dyad pairs?
- 2) What are the benefits of learning to work in dyad pairs at the clinic?
- 3) Are there any limitations that you have noticed when working together as a dyad?
- 4) Do you think there is a difference in how clinical teachers use dyad learning?
- 5) Do you have anything else you would like to add about dyad learning?
Possible ideas on how to improve it?

Subjects

Eight female dental students, aged 24-27 (mean 25 yr.), were interviewed in their last clinical year based on a semi-structured format. Female dental students at Aarhus Dental School make up about 80% of all students, and it is not unusual for clinical groups to all be women.¹⁷ Informants were purposefully selected with maximum variation sampling¹⁸ from a pool of 45 final year female students (+ 10 males) from both clinical floors and different clinical weekdays. Final year students were chosen because they had spent the most time in dyads (2½ yr.) compared to less dyad-experienced students and would therefore be the most experienced informants about dyad learning phenomena in the 3-year clinical education. Partners from the same dyad were not selected. They were interviewed with questions listed in Table 2. Student informants, as the users of dyad practice since the beginning of their clinical years, were expected to be able to give the most day-to-day, minute-to-minute details of experiences of learning activities and what works or doesn't work. The students had not received any special training in best educational practices related to same-year student reciprocal dyad practice prior to interviews. Each interview was conducted and transcribed by two female dental student co-authors. These students were from the same class as subjects chosen for the study and were aware of many of the learning phenomena they were about to study. They were given several hours of training in qualitative methods, interview techniques and transcription as instructed by the first author, who is both a clinical teacher and a senior researcher formally trained in qualitative methods.

To encourage more detail and greater in-depth answers, there were follow-up questions such as “Can you tell me more about that?” Thus, standard interview techniques were used that embrace Qualitative Description methods,¹⁸ such as confirmations and follow-ups, in order to check and supplement initial statements until each subject’s knowledge about topics appeared to be exhausted and informant and interviewer agreed to stop. A quantitative validation method¹⁹ in the form of a brief questionnaire was also used in a follow-up re-visitation of the same informants. It consisted of fourteen true / false items based on group identification and main findings of the interviews.¹⁷ The questions are listed in Table 4 in the Results section.

The research was carried out in accordance with the Declaration of Helsinki, including, but not limited to, that there was no potential harm to participants, that the anonymity of participants was guaranteed, and that informed verbal and written consent of participants was obtained.

Analyses

The students’ audio-recorded interviews were transcribed verbatim and stored in Word files following appropriate measures to ensure anonymity of informants. Average length of interviews was 9 min. 20 sec. for this topic. The text files of the interviews were then imported into NVivo software²⁰ to assist in a general inductive approach for analyzing qualitative evaluation data.²¹ In the content analyses, interview descriptions were coded by category. Codings were summarized and patterns were identified that helped clarify structure in order to support categories and subcategories of descriptions that informants thought meaningful and relevant to aims of the study. A description of brief illustrative quotes for categories/subcategories of these concepts were compiled as presented in results below. To ensure that data categories were exhaustive, data analysis ended only when there was redundancy of descriptions and no new categories or themes were discovered.^{22, 23}

All student interviews were analyzed within their social contexts and were further defined by the following scientific assumptions: 1) that informants were members of the same socio-cultural group (Danish dental students of same class, age and gender), 2) that they answered questions independently of

each other and 3) that the questions were about a specific domain (experiences in dyad learning). The true / false survey provided estimated consistency in the use of these descriptions and findings from the entire sample, that is to say, estimates of consensus for the interviewed informants. This made it also possible to evaluate if there were sufficient numbers of informants for valid results at 95% confidence level. Questionnaire responses were analyzed according to Cultural Consensus Theory which is based on a formal mathematical model.²⁴ This theoretical approach makes it possible to judge how accurately the informants described the relevant social phenomena in their responses, as well as the strength of agreement between informants. Anthropic 4.9 software²⁵ was used to calculate these consensus and informant competency parameters. Anthropic provides Cronbach’s alpha, factor analysis and Bayesian probability estimates based on patterns of subject agreement.²⁶ Table 5 contains standardized values for intersubject agreement and minimum sample size required for testing at given confidence levels, which was the guide for assessment of student results.²⁷

RESULTS

The results in Table 3 are the coded categories of student perceptions about their descriptions of dyad learning. As expected, the students described a broad range of categories due to their “insider” roll as users of dyad practice. Results by specific aims and categories of findings are also numbered below and many are accompanied by cogent quotations that illustrate each. These coding descriptions correspond to the order of findings listed in Table 3.

Overall Assessment of Dyad Practice and Learning

In reciprocal dyad practice, operators learn directly from their own clinical treatment mistakes and successes. Non-operators learn from observations during the operator’s treatment and benefit at a later stage, when they are operators. There are both advantages and disadvantages to dyad learning. Dyads can see more cases / situations and can share considerations along the way. On the other hand, there is less time as an operator in order to develop independence and fine motor skills. All informants described a net positive benefit from dyad learning, but mostly in the early years.

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Table 3. Student perception codings derived from interviews

| |
|---|
| Categories of interview findings about dyad learning |
| Overall assessment = positive, but mainly in first years |
| Advantages |
| Two brains better than one - perspectives exchanged |
| Built-in quality control |
| Sharing difficult or rare treatments; see and learn more |
| Helps avoid teacher repetitions |
| Optimizes use of teacher time |
| Provides emotional support, especially in new situations |
| Less vulnerable if partner checks rather than teacher |
| Perceived less stress |
| Disadvantages |
| Inhibits development of independence |
| Less time to train fine motor skills |
| Incompatible dyad partners |
| If partner is in bad mood |
| Cancellations affect two instead of just one |
| Passivity in non-operators |
| Communication and Cooperation |
| Learning the importance of agreement on expectations |
| Promoting learning of cooperative skills |
| Learning to share patient treatment types |
| Sharing: Let your partner try |
| Finding the right partner |
| Differences in teacher style |
| Encourages student engagement and quality control |
| Encourages reciprocal cooperation |
| Teacher who disseminates learning to several students |
| Willing to de-escalate conflicts |
| Suggestions for improvement |
| Dyad partners share endodontic patients |
| Phasing out dyad learning in later years |
| Mix up the dyads in last year |

Advantages of Dyad Learning

* **“Two brains are better than one” - to see things from a different perspective** – Informants described that the main benefit of having a non-operator was that they provide extra oversight when the operator might feel under pressure or couldn’t recall some details about theory or procedure.

Student 4: *“Dyads help by both drawing on each other’s recollection of theoretical knowledge and also by knowing each other’s previous (clinical) experiences.”*

Student 1: *“Dyads have worked out really well in terms of helping each other and seeing things from different perspectives. When there is something difficult or*

something you think may even be going a little wrong, then you can get a different view and support (then and there)... So you quickly avoid feeling stupid or insecure in front of a patient.”

* **Built-in quality control** – Informants reported that an operator’s work could be checked at any time by the non-operator and thus could maximize quality before getting a teacher’s assessment.

Student 7: *“You have two brains that can check if there is a clean excavation, before you ask a teacher.”*

In addition, they reported that a non-operator could point out if a partner was making a mistake or was in the process of doing something that was not optimal

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as pointed out by Student 1 above.

*** Sharing difficult or rare treatment types, so both can see and learn more -**

Student 8: *"..you can see many more different situations, because it can be difficult to have enough treatments (types). If it weren't for being dyad partners that share, it may well be that even if you have not done e.g. an occlusal rehabilitation yourself, you have been with your partner to do one."*

***Helps avoid teacher repetitions** – Students described that both partners in the dyad were present to listen to the information given by a teacher and thereby kept each other mindful.

Student 2: *"Often if a teacher explains something (to both); you can possibly catch something you had not understood, just because you are able to talk to your partner about it."*

*** Optimizes use of teacher time** – Students agreed that dyad practice promoted efficient use of the teacher's time within a group comprehensive clinical teaching unit.

Student 6: *"Maybe my partner might be just as good at checking and telling about (a particular step in a treatment) if it is just a filling or something (easier) like that. Then you could better use (teacher time) by asking your partner instead."*

However, student informants did not seem to think that the actual waiting time for a teacher when called was reduced, (Table 4, item 4) but rather only the frequency of standing and waiting.

*** Provides emotional security – support, especially in new treatment situations** – Many informants emphasized the importance of a supportive remark or just a reaffirming touch that seemed soothe and dampen a dyad partner's nervousness. They reported that being able to talk to a partner who saw the treatment, and understood the challenges was a built-in support.

Student 6: *"There has been both mental and professional support when you have been a little nervous. The dyad partner could just put a hand on your knee and say 'You will do just fine and you will get through this.'"*

*** Less vulnerable to check with a partner than with the teacher** - Students described feeling more secure in asking a dyad partner than a teacher about some things. One of the teacher's responsibilities is to assess clinical competency and provide feedback or critique which provides the basis for student evaluations. Therefore, informants related that dyad practice

made it easier not to ask a teacher first, if a student would have doubts. By asking a partner, the operator would either get an immediate answer to a question or confirm that the question was relevant to ask a teacher, all without signaling a lack of competence to the teacher.

Student 6: *"..knowing that the other is at the same level, it's just easier (to say): 'Can you help me with this?'. This does not have the same consequence as if asking the teacher."*

*** Perceptions of less stress when partner is by your side** – Informants described that when experiencing stress at the clinic, a dyad partner who knew a partner's limitations and strengths, was a solid support along the way.

Student 8: *"Sometimes you just get burned out. You sit in stressful situations and your brain can't even remember what you were supposed to do. It helps having someone who can support you and maybe just help remember a little more of the theoretical. You are both trying to figure things out, and you are not alone on it."*

Disadvantages of Dyad Learning

Since dyad partners must share chair time, this results in a reduced time for each student as operator. This disadvantage was described by all informants, and is categorized below.

*** Reduced possibility to develop a sense of independence** – Informants revealed that some dyad pairs may tend to cover each other's weaknesses, rather than dive into their own personal challenges. This was described to sometimes result in dependence on the other for emotional security, which made it harder for each to function independently.

Student 7: *"It is clearly about independence. In some dyads, if one partner is not so keen on doing certain tasks, then the dyad partner may have a tendency to take it over and say 'Should I do that for you?'. So you might become more timid to try it yourself, because you know each other's strengths and weaknesses so well. "*

*** Less time to develop fine motor skills -**

Student 5: *"Part of (clinical) learning is a feeling, a fine-tuned sense of having things in your hands. It takes time to learn this, because you have less operator time and that's too bad."*

*** Incompatible dyads** – Informants described that unfortunately, compatibility between parties did not always work out. It was difficult to change dyad partners along the way, since it could be a complicated zig-saw puzzle to get dyads, clinical groups as well as

clinical teachers coordinated. Generally, it took a lot before incompatible partner problems became so serious that they needed to be broken up. Fortunately, this was rarely experienced by students in the present study. However, there was knowledge of such experiences and their unwanted consequences.

Student 3: *"It's awful not to have a choice about a partner in some situations, like a transfer student. So you can get forced into a bad situation of sitting with someone with whom you don't work particularly well."*

*** If a partner is in a bad mood** – Informants told that moods of dyad partners were very important for each individual's experience at the clinic. If a partner was in a bad mood and/or had symptoms like headache or stomachache, this could result in a negative experience and even a reduced desire to be at the clinic.

Student 5: *"From what I have heard, sometimes one of the partners can show up at the clinic with a tummy ache or a bad mood and doesn't even want to be there. If you can feel something's (wrong), especially if the partner says nothing, then it's difficult working together. So, yes, it can sometimes actually become a drag to be in a dyad situation.."*

*** Cancellations affect two, not just one** - When a dyad operator got a cancellation, it also affected the non-operator. This often resulted in a doubling of "wasted time".

Student 4: *"When you get a cancellation it is awful. It hits you both. You both have other patients you could have called in."*

However, students noted that they often could call in flexible patients or other dental students as patients in these "same day" situations.

*** Passivity** – Informants revealed that non-operators could perceive an operator's treatment as no challenge and would have preferred to be able to operate a treatment themselves.

Student 6: *"I can feel that I have become so independent that I can't just sit there like a rock..."*

Communication and Cooperation in Dyads

In descriptions of advantages and disadvantages of dyad learning, students often mentioned the need for good cooperation and thus also a need for learning of good communications skills. Since these skills were often described in some detail, they seemed to be part of the dyad learning process and deserved a whole category for analysis.

*** Learning the importance of agreement on**

expectations about style and individual need

– Students informed that people do not always work the same way or in the same tempo and small conflicts were difficult to avoid where there were time pressures.

Student 5: *"If you don't have an agreement from the start (about how to work together), there are some incidences where partners (perceive they) have not helped each other equally that leads to problems or irritations. Expectations can also change with time."*

The importance of regularly expressing one's needs and expectations was described as a part of good cooperation that maximized learning and motivation to learn.

***Promoting learning cooperative skills** - The learning described between students in dyads often gave detailed contextual insights into the everyday life that awaits a dentist in practice.

Student 8: *"Learning to sit on the other side of the chair is also an advantage later, since you have tried being a clinical assistant".*

In the example above, the non-operator would learn to think ahead and take initiatives to obtain necessary materials and equipment to be more efficient in treating a patient. Not only was this good for improving operator efficiency, but also for both to learn appreciation for required preparation time, procedural details and the role of dental assistants.

*** Learning to share patient treatment types** – Students often encountered a lack of specific treatment types at the teaching clinic and it was not always possible to distribute them according to each student's operative needs or wishes. Dyads working together on a rare or especially difficult treatment minimized this scenario, as described in the example above about sharing an occlusal rehabilitation patient.

*** Sharing: Let your partner try** – Students sometimes thought it was advantageous to allow a dyad partner to try something with which the other was having difficulty. It could be that a dyad partner could resolve the task or also confirm that the task was too difficult and that a teacher was needed to help resolve it.

Student 6: *"Just let your dyad partner try, because you have different ways to tackle it. Maybe it works out easier for the dyad partner."*

*** Finding the right partner** - Student informants emphasized how important it was to find someone with the same mentality, both in how they relate to patients and each other.

Student 3: *"It is a good idea to choose someone on the same wavelength while in pre-clinical courses, because otherwise it can end up going sour. My partner chose me after both of our original dyad partners dropped out. (We knew each other) so, we decided to try. It ended up leading to a kind of 'dyad love'!"*

Teacher Differences About Dyad Learning

Informants described a wide range of differences in student experiences with roles and values of their clinical teachers in regards to dyad practice.

Student 5: *"There are some teachers who insist students always sit in dyads. There are others where you hear, even for new students, 'If there is an extra chair, then you must sit separately.'"*

Other students described more specifically positive aspects of teacher educational efforts to facilitate dyad and group learning as reported below.

* Encouraging student engagement and quality control

Student 3: *"Some teachers are really good to ask (the non-operator) 'Would you please check before I check?'"*

Student 6: *"So I think one can use one's dyad partner for more, especially if suggested by the teacher. It's not necessary to have the teacher check every little thing, especially in the 9th semester."*

* **Encouraging reciprocal cooperation** - Usually the dyad pair figured out between themselves to distribute patients. However, it was also important to some students that teachers also encouraged sharing and, in particular, intervened among dyad pairs where there was less balance in the distribution of treatments.

Student 5: *"There is always someone who has 'sharp elbows' and causes some problems with sharing. I think generally that teachers feel that we have to take care of it ourselves, but it could be better if they were more a part of it."*

* Teachers who disseminate learning and clinical observations to include several students

- Informants described positive aspects of some teachers who shared an especially educational case or clinical situation in a kind of clinical seminar format that helped students to be able to see more cases.

Student 1: *"One of my teachers was going to demonstrate taking an impression for a crown. He called other dyad pairs over. So several dyads got to see it and everyone could learn from it."*

* **Willing to de-escalate conflicts** - Students wanted the clinical teacher to be aware of dyad conflicts and to

intervene or at least listen as the need arose. Students also saw this as a suggestion for improvement of dyad practice.

Suggestions for Improvement

* Dyad partners sharing endodontic treatments

- Sometimes there was a scarcity of treatment types for the students. This was students' perceptions about endodontic treatments at the present clinic. Informants suggested dyad practice in the chair-limited endo specialty clinics at the dental school. Dyads had only been voluntary to the present. Students also suggested that given their same theoretical level of knowledge in the field, working in dyads should fulfill endo quantitative credits in some way.

* Dyad learning in earlier clinical years; phasing out in later years

- Students described that when they started at the clinic, dyad learning had a big advantage, as there were many new treatments they had not yet seen or felt secure about doing alone. As years went by at the clinic, students described becoming more self-confident and competent. Nearly all student informants thought that phasing out dyad practice sometime later in the second clinical year would be advantageous to learning independence and fine motor skills. Otherwise, dyad practice could lead to passivity among non-operators.

Student 2: *"In the beginning I think it's (dyads) worth it, but when you get to the (late) 7th or in the 8th semester, I don't really think it's worth as much, because we already know more and it seems tedious to just sit and suction for a crown."*

* **Mixing dyad partners up in the last year** - In the 9th semester (start of the third year), the dyad couples often broke up in the Treatment Planning unit. In Pedodontics, two random students from the larger group were assigned for each treatment, i.e., the dyad mix was determined by the clinical assistants.

Switching dyad partners was described as providing an opportunity to observe different approaches to management of patients.

Student 6: *"Each student would gain more experience about how others work, their habits and routines, compared to just having the same dyad partner (or teacher) for 3 years. e.g. at the BPE clinic (treatment planning) and at Pedro. I think it worked really well."*

Consensus and Informant Accuracy Table 4 indicates a high degree of consensus and informant accuracy within this group of students at .95 CL (Table 5) according to their cultural identity and main findings of the interview data.

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Table 4. Survey results: Percentages of true false answers for the 8 student subjects
Consensus (α) reliability = 0.97; Mean Informant Competency = 0.89; SD = 0.28

| | True | False |
|---|------|-------|
| 1) I am a female dental student in my last clinical year. | 100% | 0 |
| 2) I am younger than 30 years old. | 100% | 0 |
| 3) I speak fluent Danish. | 100% | 0 |
| 4) When working in dyads, you often save time waiting for the teacher. | 25% | 75% |
| 5) When working in dyads, you get more operating time yourself. | 0 | 100% |
| 6) You learn a lot about how to cooperate with others when working in dyads. | 100% | 0 |
| 7) When patients cancel, it adversely affects both students in a dyad pair. | 100% | 0 |
| 8) You become less secure with new treatments when you are in a dyad pair. | 0 | 100% |
| 9) There is no difference in teacher and educational skills in the clinical education. | 0 | 100% |
| 10) A good dyad relationship makes clinical learning less stressful in the beginning. | 100% | 0 |
| 11) As operator, I often learn from a non-operator's different perspective. | 86% | 14% |
| 12) A "good instructor" doesn't encourage dyads to control quality of each other's work. | 0 | 100% |
| 13) Collaboration in dyads is very important in the beginning (from 5th sem) than later. | 100% | 0 |
| 14) It's important to find a balance in dyad learning vs. learning to work independently. | 100% | 0 |

Table 5. Standardized chart for minimal number of informants needed to classify desired proportion of questions with a specified confidence level for various levels of cultural competence (Note for clarity: 0.50 is considered "good" mean intersubject agreement*)

| Proportion Of Questions answered "correctly" | Consensus (average level of cultural competency:) | | | | |
|--|---|-----|-----|-----|-----|
| | .50 | .60 | .70 | .80 | .90 |
| At .95 Confidence Level: | (Minimal number of informants needed:) | | | | |
| .80 | 9 | 7 | 4 | 4 | 4 |
| .85 | 11 | 7 | 4 | 4 | 4 |
| .90 | 13 | 9 | 6 | 4 | 4 |
| .95 | 17 | 11 | 6 | 6 | 4 |
| .99 | 29 | 19 | 10 | 8 | 4 |
| At .99 Confidence Level: | | | | | |
| .80 | 15 | 10 | 5 | 4 | 4 |
| .85 | 15 | 10 | 7 | 5 | 4 |
| .90 | 21 | 12 | 7 | 5 | 4 |
| .95 | 23 | 14 | 9 | 7 | 4 |
| .99 | >30 | 20 | 13 | 8 | 6 |

* Weller SC, Romney AK: Systematic data collection. Newbury Park, CA, Sage, 1988:77.²⁷

DISCUSSION

The purpose of the present study was to explore user experiences and perceptions of learning in dyad practices at a Danish dental school teaching clinic. Eight final year clinical students in interviews described their overall perceptions of dyad learning, as well as specific advantages, specific disadvantages, teacher styles or strategies and suggestions for improvements.

There are important caveats to keep in mind regarding the present results. 1) Although these qualitative results may be representative of Danish female dental students, who are the large majority of Danish dental students, they may not be for males or other student nationalities. Cultural influences on student motivations and learning environments can vary from nation to nation and by gender. 2) Student informants were selected using a qualitative research strategy. However, in spite of a low number of informants, there was very high test agreement among these independent informants according to Table 4. These test results lent credibility to estimates of validity and reliability of the findings. 3) No specific measures of stress or self-efficacy were used for comparisons with results in this study. Efforts were focused solely on informants describing their own experiences and perceptions about dyad practice. Finally, the insights from this study need to be replicated and/or directly compared with conventional individual learning in a dental school environment in future research before drawing conclusions about any learning efficiency improvements that dyad learning may have over individual learning for dental students. As stated in the aims, present study was meant to explore unknown variables of reciprocal dyad learning for clinical dental students in order to gain some knowledge that would contribute to future research and informed educational policy.

Given these caveats, present results generally were similar to an undetailed 2016 summary report in Danish¹⁴ after preliminary evaluation of the then newly instituted dyad practice. The summary reported that first year clinical students were very positive about dyad practice and referred to built-in social support and ease in building self-confidence. Second-year clinical students, who spent 75% of their time in dyad training, reported some “wasted time”, e.g. with repeated impression taking. Last year students

who spent about 50% of their time in dyads were very satisfied. Authors of the report suggested that second-year clinical students have, in general, a very hard-pressed academic year, and this might have been the cause for negativity, especially in the introductory year (2014-5) of formalized dyad practice.¹⁴

Present informants agreed that dyad learning was more advantageous than not, but mostly at the beginning of the clinical learning experience. They described a number of specific benefits from dyad learning and that these seemed to outweigh the disadvantages.

Present informants clearly referred to a positive, so-called “two brains are better than one” phenomenon described in the dyad learning literature.^{15, 16} These dental students described their “shared memory banks” as the main advantage of dyad practice, both for recalling theoretical knowledge and procedural considerations. The “extra pair of eyes” in dyads helped them to discover possible flaws or helped an operator to avoid mistakes, which also turned out to be beneficial for optimizing teacher time. They also described that when the operator was under pressure and had to focus, the non-operator had a better overview and could make real-time assessments about the treatment and the operator’s performance. This advantage was also observed in a study of medical students,¹⁶ where individual self-regulated learning and dyad learning were compared on different parameters.

Learning taxonomies typically describe clinical learning in major headings of cognitive, emotional and motor skills learning.⁷ Dyad learning described by present informants seemed to provide learning in all three. Results pointed to an intrinsic motivation to learn, in these clinical/social situations, which promoted effective ways to tackle clinical procedures in dyad learning. A partner might not have completely grasped a clinical concept until having to explain it to the other, embodying and crystallizing thought and theory into clinical language. When dyad partners help each other with a clinical skill, it sharpens the skill in both partners’ minds.²⁸ Since dyad learning also places heavy demands upon the communication and emotional skills of both operator and non-operator, dyad practice also intrinsically motivates informal development of those skills. Listening, explaining, questioning, summarizing, speculating, and hypothesizing are all valuable skills which are transferable in dyads.²⁸

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Arguments above are well-known and theoretically backed by Social Interdependence Theory.²⁹ In order to coordinate efforts to achieve mutual goals, dyad partners must 1) get to know and trust each other, 2) communicate accurately and unambiguously, 3) accept and support each other, and 4) resolve conflicts constructively. Since present dental students described self-confidence and professional support when working with a stable dyad partner, one could assume that they had learned some or all of these psychosocial skills. These considerations are similar to conclusions found in studies of medical students in dyad practice.^{17, 30, 31}

Some authors^{7, 32, 33} have also proposed why learners may sometimes feel more at ease with a nearby PAL learning partner than with a senior expert,³² like a clinical teacher, as described by some of the present students (Table 2). According to Vygotsky's Theory of Social Congruence,³⁴ learning is optimized and greater intrinsic motivation for learning may occur beyond the teacher-student relationship because of needs that arise closer to the learner. Dyad partners are more of the same mind-set and easier to contact than teachers and thus more likely to share their common knowledge base initially.³⁵ A clinical teacher may not always immediately understand the students' cognitive or emotional intricacies in processing new clinical experiences.³⁶ Present dyad partners described that they consulted with each other first before calling a teacher for instruction or final quality checks.

The concept of self-efficacy in the context of Peer Assisted Learning,^{4, 7} also seems highly relevant to the discussion of present results. Self-efficacy is a student's "sense of being able to do" a task and/or "feeling confident or competent" to execute learned skills or attitudes in their education.³⁷ Bandura's Social Learning Theory³⁷⁻³⁹ posits that besides theoretical and directly conditioned learning, people also learn from one another via 1) observation, 2) imitation and 3) modeling. Observational learning occurs constantly and exposure to influential others' behaviors provide new learning through the modeling process. Studies on medical students showed that PAL and dyad practice provided learning through observation, feedback and cognitive support,^{4, 7, 32} of peers more often than immediate teacher contacts.⁴⁰ Present non-operators observed and consulted with the operators constantly, thus providing abundant opportunities for the operator to build up self-efficacy

and self-confidence. This collaboration may best benefit learning when learners are novices making errors during their training.³⁹ Tolsgaard et al⁷ also reported that medical students learned from the mistakes of others, especially in learning complex motor skill patterns.⁷

In the present study, the most frequently described disadvantage of dyad practice was reduced operator time, and thus, reduced time to develop independence and fine motor skills. Tolsgaard et al⁷ described a model that collaborative medical student dyad learning was most effective in a period of early skills acquisition when cognitive load was high compared to later, when the cognitive load decreased and reductions in hands-on time made collaborative learning increasingly ineffective.^{7, 15} They also emphasized the importance of hands-on time and how this helps to create "increasing levels of automaticity with sustained practice."⁷ It takes many hours of practice to train these fine motor skills. Summarily then, dyad learning of clinical skills depend on the type of learners, the complexity of task and quality of learner interactions.⁷

Informants observed differences in how teachers approached dyad practice. In some cases, the non-operator was encouraged to do quality control checks of the operator's work. Teachers tested both the operator and non-operator clinical and theoretical knowledge during treatments. However, there were some teachers who addressed only operators in their instruction and checks, thus leaving the non-operator with a more passive role. Student informants reported that teacher promotion of engagement was especially motivating and lauded. This was especially true when a teacher would call several dyad pairs to a specific clinical situation as a kind of on-the-floor seminar. Undoubtedly, since dyad learning is different from individual learning, it would benefit clinical teachers to have some guidance about how to optimize PAL or dyad learning with in-house teacher training.

Informants described a number of suggestions for optimizing dyad learning. Among other things, it was suggested that partners also work together in their dyad pairs in specialist endodontic clinics, which has only been voluntary to date. Since there sometimes is a lack of patients with need for endodontic treatments or other less available treatments, like periodontal surgery or oral rehabilitation, dyad practice could also possibly be used for credit in quantitative clinical requirements.

Students agreed that dyad practice should be phased out later in the teaching clinic, to improve autonomy and fine motor skills before becoming practicing dentists. They indicated that dyad time should be cut from the current 75% to lower levels sometime in their second year (e.g. 8th semester of the 10 semester program). Similar suggestions were made in a study of medical students.⁴

More generally, several students suggested that it might be appropriate and instructive to change dyad partners occasionally, instead of being limited with the same partner in all three clinical years. In doing so, other approaches and ways of handling patients could be modelled, resulting in a wider range of experiences in the clinic.

Finally, it appears from present results that there is a potential for greater educational efficiency using dyad practice as the main clinical teaching model rather than conventional individual learning. This must, of course, be tempered with the importance of the need for students to learn independence and fine motor skills. Tolsgaard et al⁵⁻⁷ have concluded, after several studies of medical students, that dyad or other collaborative learning formats could help maintain high-quality medical training in the face of increasing numbers of students in medical schools in the future. This could also apply to more efficient and comparable or improved learning for increasing numbers of dental students, as is the current trend in Denmark.¹⁴ Cost effectiveness is part of the attraction of this educational concept. Initially, this would be expected to create some doubts about dyad learning quality in the minds of students and the dental profession as a whole in other nations, much as occurred before Aarhus adopted dyad practice as its main clinical teaching model.

CONCLUSION

Present informants described same level reciprocal dyad practice to be highly beneficial, especially in their first years as clinical dental students. Informants described that dyad practice tended to promote student self-efficacy and informal learning of clinical and communication skills. They were positive about having a dyad partner as a ready reference for theory at chair-side, as well for emotional support, thus possibly reducing the stress of a notoriously highly stressful education. Good personal relationships and activity levels appeared to be conducive to good

learning and increased motivation in present dyads.

The most frequently discussed disadvantage was reduced hands-on clinical experience. Although they could not assess the significance of reduced chair time, students suggested that dyad practice be limited to the first years of the clinical education. Thus, although dyad practice may not be a panacea for effective learning for all clinical student academic levels, it appears to provide a good basic model for improving educational efficiency, while also maintaining, or even improving, the quality of dental clinical education, given appropriate attention to balancing dyad and individual practice.

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Citation: Rod Moore, Anne-Sophie Freitag, Anna Drejer Hansen. *Dental Student Perceptions of Learning in Dyad Practice - A Qualitative Study*. *Archives of Dentistry and Oral Health*. 2021; 4(1): 01-14. DOI: <https://doi.org/10.22259/2638-4809.0401001>

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