



Clinical Practice in Prosthetics and Orthotics: A Pilot study on students' perception of the effectiveness of the integration of Research in the undergraduate curriculum

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Abstract

Background: Problem-based learning has been considered an alternative approach to learning through which many students have enabled themselves to acquire knowledge from an unclear medium of wrong and correct answers. Problem-based learning can offer students opportunities to engage with complexity and help them see ambiguity and learn to manage the ambiguities that prevail in professional practice. Despite known benefits, the effect of this mode on the learning experience of Prosthetics and Orthotics students has never been tested.

Study design: Qualitative pilot study

Methods: A grounded theory methodology was adopted, and a focus group of five fourth-year students was interviewed to explore and evaluate the students' perceptions.

Results: Students have shared their insights and experience in research-informed clinical practice. They stated that this is an excellent method of education in the transaction of the curriculum in Prosthetics and Orthotics. They elucidated its benefits and advocated in favor of research-informed clinical practice.

Conclusion: Students promulgated that their learning experience and level of clinical practice have improved significantly after the intervention of research-informed clinical practice. It is a methodology that simulates self-learning and allows the students to practice when facing real situations and to identify their knowledge deficiencies. Students can observe their progress in developing knowledge and skills, becoming aware of their development. This may lead to more knowledgeable graduates equipped with enhanced clinical practice.

Keywords: research, problem-based learning (PBL), research-informed clinical practice (RICP), prosthetics and orthotics, clinical practice, prosthetist, orthotist, students

INTRODUCTION

Problem-Based Learning (PBL) is pedagogy in which students learn about a topic through the experience of solving an open-ended problem found in elicited material. In this way, students decide on the information they wish to acquire and how it is relevant to their study area.⁵ The PBL method does not focus on problem-solving with a definite result but leads to developing other appropriate skills and different characteristics, mainly knowledge acquisition, enhanced group collaboration, and communication.

Many researchers have identified several benefits of implementing PBL in clinical teachings, such as improving learners' skills in (1) acquiring knowledge, (2) interpolating information and (3) communicating with team members.²

However, in their meta-analysis, Albanese and Mitchell⁶ documented that weaknesses can be found in PBL, and they must take into account the cost, the cognitive variations between students, and the time at which students are directed to PBL as part of their learning. Taking into consideration the benefits and weaknesses of PBL should improve students' self-learning, understanding, and clinical reasoning and encourage students to learn more.

The PBL method was developed for medical education and has since been broadened in applications for other learning programs. The process allows the learners to develop skills used for their future practice. Recently, PBL has been a subject of interest as a teaching method,⁷ and Despite being studied in different fields, the effectiveness of PBL for Prosthetics and Orthotics (P&O) students has never been tested. Therefore, driven by their belief that PBL has a substantial impact on the teaching process, the Rehabilitation Council of India (RCI), in consultation with P&O experts, implemented an imperative change in how the clinical practice module is executed for P&O undergraduate students within their last year. The module lasts for nine months (720 practical hours). Students were trained in making a Prosthesis and Orthosis and were also directed toward developing their evidence-based practice. It was postulated that such a change would augment students' understanding of the P&O principles and build their learning experience, and may lead to positive research outcomes.

Table 1. Student interview questions

1. What do you think of RICP (Research-Informed Clinical Practice)?
2. Tell me about things that helped you to learn during your empiricism with RICP.
3. Tell me whether you have faced any obstacles during your empiricism with RICP.
4. What did you gain during RICP (theoretically and practically)?
5. How will your expertise within RICP reflect on your clinical practice?
6. What and how have you benefitted from your research involvement?

RICP: research-informed clinical practice

MATERIALS & METHODS:

The subject was named Orthotics and Prosthetics Clinical Practice/ 'research-informed clinical practice' (RICP) and was undertaken in the course. This module assigned ten patients to each student (five requiring orthotic and five requiring prosthetic treatment). Based on pertinent literature and research-informed clinical practice, students were to assess the patient's condition, identify an intervention strategy, manufacture, check, and finally deliver the patient's treatment (prosthesis/orthosis). These tasks were performed under the guidance of the supervisors (certified Prosthetists and Orthotists), who provided supervision while dealing with the patient and manufacturing the prosthesis/orthosis and controlled (via e-mails) while searching the literature. For each patient, the student had to submit a case study and undertake an oral examination once the prosthesis/orthosis was delivered.

At the onset of this module, students underwent an induction week to familiarize themselves with the concept of the RICP and train them on the literature search using a different database (e.g., PubMed). After completion of the module, comments on the effectiveness of RICP were collected from a focus group.

Focus group interviews with a randomly selected sample were conducted to examine students' comprehensive experience of RICP. The sampling delineated half of the fourth-year cohort (n=8). After assigning numbers to each of the 16 fourth-year students, eight were randomly selected, and they were professed.

The interviews were designed to draw inferences from the students' supposition of RICP to establish its effectiveness in enhancing students' clinical practice. In the interviews, the students were asked five questions listed in table 1. These questions were derived from a study conducted to address the same objectives but in the field of radiography.⁸ The interviews were informal face-to-face conversations directed to each student in the same order presented in Table 1. Students answered the questions without parenthesis. Only one student was interviewed at a time.

The interviews were audio-recorded to keep the conversation smooth. Each student in the focus group was given a number that was used to label their interview record to ensure anonymity. The interview was estimated to take about 30 minutes to be completed.

Data Analysis:

The recordings from the focus group members were transcribed verbatim in a manner that emulates the interviews.⁹ Grounded theory was used for analyzing the data.^{1,10-12}

Grounded theory is used to discover rather than verify or test an existing theory. Notably, after data collection, the data are labeled into categories. Interrelationships between these categories are identified from which a theory is developed.

Further, to categorize and subcategorize the data, open coding was used. To create a discriminate coding and as suggested by Strauss and Corbin,¹³ questions were made precise. Five categories were corroborated: students' outcomes from the RICP, students' perspectives about integrating RICP in teaching, students' evidence-based practice, students' enthusiasm to conduct research, and changes in students' clinical practice. Three subcategories were also identified: formative student experience, devastating student experience, and improved student research practice.

Then, axial coding was used to:

1. Compare the transcript with the five categories.
2. Link categories and subcategories.
3. Specify the subcategories' properties and dimensions.
4. Identify the difference in students' experience when integrating RICP into teaching.

Finally, selective coding was used to recognize the 'story' by identifying the main category, associating it with the other categories, and authenticating correlation after gaps in categories had been filled.

RESULT: In Table 2, students' quotes are classified based on the five categories derived by the open coding. All students in the focus group had an attributed impression of tactical acquiescence about RICP that it is an excellent and effective method of education in Prosthetics and Orthotics.

Table 2. Students' perceptions are categorized based on five categories discovered in the open coding.



The five categories identified by open coding

Students' outcomes from the RICP (research informed clinical practice)

Students' perspective on integrating RICP into teaching

Students' evidence-based practice

Students' enthusiasm for conducting research

Students' perceptions

1. 'RICP is an integral part of any clinical practice, specifically in clinical prosthetics and orthotics, where many device options are regularly presented to patients and their treating physiatrists.'

2. 'I learned to look for new information and knowledge rather than being fed further information by adopting a problem-solving orientation to practice.'

3. 'I began to link my major with other majors and how to benefit from different fields of knowledge. This leads to judicious use of available resources, better knowledge of the lack of resources, and genuinely fruitful outcome.'

1. 'It was the best learning experience I have ever had. It enhanced awareness and interest in applying systematic and logical reasoning in decision-making.'

2. 'Unlike the spoon-feeding educational method, RICP allows us to be creative. Understanding research methodologies and interpretations of the result satisfied me to translate information imparted in prosthetic and orthotic reference manuals and reading materials more analytically and accurately.'

3. 'Unlike other modules, how you learn during this module makes it easy to remember everything.'

1. 'I began to discuss ideas and information confidently with supervisors and students based on information I found in the literature. In the field of Prosthetics and Orthotics fitment journeys of every patient is different, so the more we practice considering all guidelines mentioned in our journals and practically possible solutions gives rise to more chance of getting more successful outcomes.'

2. 'Literature review helped me to improve and broaden my clinical skills. I understand that the number of outcomes does not make a result but instead informs us about the compatibility of an effect.'

3. 'After this term, I can say that I can use and spread newly developed approaches that have never been used in the place where I am working...RICP helps to perform evidence-based clinical practice, which ensures high-quality treatment with a predictable and planned treatment outcome, providing proper care and recovery of patients.'

1. 'Despite that one of the theoretical modules I completed before this term was about research methods, only after this module, did I realize the importance of research and its influence on our clinical practice.'

2. 'Before this term, I was not too fond of research, but now I would love to conduct research. Getting involved in a research study has made me clinically and practically more sound. The benefits from involving in the research were that it helped to foster clinical thinking and analytical skills.'

Changes in students' clinical practice

3. 'It would be useful to introduce a research club in which students would discuss articles under the supervision of senior orthotist and senior prosthetist.'
1. 'After the module, I feel more confident that I am a certified Prosthetist and Orthotist.'
2. 'In the future, I would not assume that a clinical practice' is wrong or right unless I have evidence from the literature that supports or oppose this practice.'
3. 'Now I can examine different clinical approaches, combine them and choose the best for my case. E.g., It helped me to understand that five similar patients with the same diagnosis can give five completely different results, so we cannot jump to a conclusion merely seeing a patient. A thorough clinical assessment, designing, and planning fitment journey is a must for every patient to be fitted by a Prosthetist and Orthotist.'

A student said that RICP was the best learning experience he has ever had. The further student added that RICP enhanced awareness and interest in applying systematic and logical reasoning in decision-making.

Also, students agreed that RICP enhanced their clinical experience, as in this process, students were allowed to work with a relatively large number of patients.

Students were instructed to complete their case reports after 4 p.m. at home or the Institute computer laboratories.

RICP is an integral part of any clinical practice, specifically in clinical prosthetics and orthotics, where many device options are regularly presented to patients and their treating physiatrists.

RICP was introspected to foster student's creativity:

Understanding research methodologies and interpretations of the result satisfied me to translate information imparted in prosthetic and orthotic reference manuals and reading materials more analytically and accurately.

Students explained this by having to study, search and learn by themselves (self-learning) about their patient's medical condition to find the most appropriate prosthetic and orthotic prescription (evidence-based) rather than being instructed by a supervisor. Self-learning was made achievable by providing students with intensive training on literature search strategy and how to use different databases to find information relevant to the case(s) they were assigned. Students seemed to value this self-learning approach that was inherently implemented in the RICP; students believed that it helped them to absorb knowledge effectively:

Students were prompted to criticize the medical prescription prescribed by the rehabilitation or orthopedic consultants and to propose evidence-based alternatives if possible. This seemed to boost the self-confidence of some students:

After the module, I feel more confident and think I am a certified Prosthetist and Orthotist.

Students mentioned several aspects that helped them to learn during RICP. Most students agreed on two main elements: the induction week and the supervision. Regarding the induction week, as discussed before, familiarizing the students with the module requirements and providing them with fundamental research, critical appraisal, and how research is conducted are required to complete this module successfully.

The focus group suggested that supervision was essential in directing learning. Supervisors mainly provided the students with feedback on their case reports and directly instructed them in clinics. On several occasions, supervisors also directed students toward the relevant references and articles and explained unfamiliar concepts/principles of therapeutic or measurement techniques. This was conducted through regular discussion meetings or informally whenever the student sought help. The nature of the discussion meetings seemed to influence the students' self-confidence positively and to break the sense of hierarchy between teachers and students:

I started discussing ideas and information confidently with supervisors and students based on information I found in the literature. In the field of Prosthetics and Orthotics fitment journeys of every patient is different, so the more we practice considering all guidelines mentioned in our journals and practically possible solutions gives rise to more chance of getting more successful outcomes.

On the other hand, it is worth mentioning that not all supervisors appeared to provide efficient feedback on the student's report or enough number or duration for discussion meetings. Students generally sought help from other supervisors (not assigned to them) whenever they received unsatisfactory feedback.

In clinical practice (i.e., during clinical work), most students found it problematic to have feedback from different supervisors on one case. In particular, they had conflicting feedback from different supervisors on some occasions. Having different supervisors in the practical part was confusing as I sometimes got contradicting feedback.

DISCUSSION:

Besides the mannerism of the supervisor's feedback, students found RICP time-consuming and exacting. This might be mainly due to the structure of the orthotics and prosthetics program, which has academic and clinical requirements. Students also faced difficulty accessing the literature due to the limited number of databases accessible from the Institute.

The English language is used to run the entire P&O program. Also, RICP gave a belief that self-learning is entirely possible.

I learned to look for new information and knowledge rather than being fed further information by adopting a problem-solving orientation to practice.

In clinical practice, students appeared to benefit from the literature in which novel techniques and cutting-edge technology are introduced. Students probably also felt more particular about the outcome whenever they read literature related to the case(s).

I understand that the number of outcomes does not make a result but instead informs us about the compatibility of an effect. RICP has enabled me to review and synthesize applicable data from various clinical trial publications, scientific journals, and papers. It equips me to present accurate scientific information to my patients, who can then make an informed decision about their treatment plan.

Students have begun to critically assess any clinical practice even if practitioners had widely accepted it:

I would not assume that clinical practice is wrong or right in the future unless I have evidence from the literature that tests this practice.

Now I can examine different clinical approaches, combine them and choose the best for my patients.

Although the focus group students value practitioners' advice, they collectively revealed their tendency to review the literature to learn how to deal with unfamiliar cases. They highlighted that they would not be afraid to introduce to others any newly empirically supported clinical practice they find in the literature or suggest any improvement to currently used methods.

Now I can use and spread newly developed approaches that have never been used in the place where I am working. RICP helps to perform evidence-based clinical practice, which ensures high-quality treatment with a predictable and planned treatment outcome, providing proper care and recovery of patients.

In contempt, all students had completed a module in research methods before RICP and had a vague and nebulous idea about it; only a few valued the role of research in scientific development.

However, following RICP, perhaps because students read articles related to actual cases they dealt with, they showed a better understanding of research methods.

Despite that one of the theoretical modules, I completed before this term was about research methods, only after this module did I realize the importance of research and its influence on clinical practice.

Before this term, I was not too fond of research, but now I would love to conduct research. Getting involved in a research study has made me clinically and practically more sound. The benefits from involving in the research were that it helped to foster clinical thinking and analytical skills.

Most notably, a student suggested establishing a research club at the Institute aiming to change the student's perspective toward research:

It would be helpful to introduce a research club in which students would discuss articles under the supervision of a Senior Orthotist and Senior Prosthetist.

Presumptively, due to the structure of a P&O program derived from different fields of knowledge, students seemed to understand the importance of teamwork. In this research approach, it is possible to affiliate concepts and paradigms from other areas of expertise.

I began to link my major with other majors and how to benefit from different fields of knowledge. This leads to judicious use of available resources, better knowledge of the lack of resources, and a genuinely fruitful outcome.

In summary, RICP aims to enhance students' self-learning skills and encourage them to build a nexus between knowledge and their clinical practice. This investigation apprised that PBL was more successful than traditional approaches regarding students' satisfaction and evidence-based clinical practice. Also, students have elucidated an improvement in their academic performance following the RICP, reflected in their marks. This suggests that

implementing PBL into the curriculum of P&O undergraduates is worthwhile, mainly because previously identified weaknesses in PBL from the literature⁵ were not faced in this investigation.

Even so, further investigations in this area of research are needed. Mainly, studies on larger sample sizes are required to generalize obtained results possible. Teaching the student to RICP in the preceding term may have been more beneficial in many aspects (i.e., better literature search skills and understanding of knowledge). Finally, the RICP covered both prosthesis and orthosis aspects in this investigation. An RICP that focuses on orthosis and another on prosthesis may be more beneficial and practical for students. However, a few of the challenges accompanying PBL methodology should be considered to improvise it.

CONCLUSION:

The study explored the value of integrating PBL into the teaching process of P&O undergraduate students. The evidence from the focus group justifies the use of such integration. Students demonstrated that the RICP helped them understand the concepts behind their clinical practice, and their way of dealing with patients regarding diagnosing, prescription, and manufacturing has improved. Students expressed increased interest in incorporating evidence into clinical decisions and using the literature to support their work as P&O clinicians. Furthermore, students' ambition to pursue research has been boosted because they chose to undertake research.

The knowledge acquired from this study will help inform and develop the content of the P&O undergraduate curriculum in a way that further integrates PBL into teaching, and information will be used for further research.

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