Objectives. Problem-based learning (PBL) is increasingly being used within health care professional educational programs to develop critical thinking skills via a learner-centered approach. However, few studies have evaluated the effect of participation in a PBL-centered curriculum on occupational therapy knowledge and skill development over time from the perspective of the students involved. This study examined student evaluations of the first three class cohorts participating in a PBL-based curriculum.

Method. A participatory action design study involving qualitative, student-led focus groups was conducted with 154 students across 2 years of the education program. Fourteen focus groups were audiorecorded, and those audiotapes were transcribed by an outside expert, followed by two levels of analysis by program faculty members and a member check by student participants.

Results. Themes that emerged from the data analysis related to (a) defining elements of PBL, (b) the role of students and faculty members, (c) learning strategies used by students in a PBL versus traditional education program, (d) the challenges of a PBL approach, and (e) PBL’s relationship to clinical reasoning and occupational therapy practice.

Conclusions. Students perceived that a PBL approach adopted consistently across the curriculum contributed to the development of information management, critical reasoning, communication, and team-building skills; however, identified challenges were time and role management, information access, instructor versus PBL expectations and practices, and coping with the ambiguity of knowledge and reasoning.
effective in the field of medical education (Albanese & Mitchell, 1993; Foley, Polson, & Vance, 1997; Schmidt, 1983; Tosteson, 1991; Williams, 1992) and has been implemented either wholly or partially in dentistry (Ferrier, 1990), nursing (Lewis & Tamblyn, 1987), pharmacy (Rangachari, 1991), physical therapy (Solomon, 1994), and occupational therapy (Hay, 1997; Royeen, 1995; Royeen & Salvatori, 1997; Saarien & Salvatori, 1994; Stern, 1997; VanLeit, 1995).

PBL may be defined simply as “the use of problems to focus learning” (Albanese & Mitchell, 1993, p. 71). It does not focus on direct lecture-based instruction with expert answers but rather guides and facilitates the student in probing problem-setting and problem-solving processes within an inquiry-based format that is student directed. PBL curriculum implementation may include one or more of the following:

- An instructional format using tutorials or small discussion groups focusing on problem setting and problem solving of clinical cases (Barrows, 1989)
- Student learning in the context of patient problems (Albanese & Mitchell, 1993)
- Prior learning explicitly linked to previous knowledge of the learner (Bransford, Sherwood, Vye, & Rieser, 1986)
- Organization of knowledge on the part of the student as an explicit aspect of the curriculum (Bransford et al., 1986)
- An effective clinical reasoning process is needed to hone problem-solving skills, such as hypotheses generation, self-inquiry, data analysis, problem synthesis, and decision making, and can be developed via PBL (Barrows, 1989)
- Another fundamental aspect of PBL is that the focus is taken away from the teacher and placed on the learner. Thus, PBL is characterized by students’ active engagement in the process of “learning to learn” (Williams, 1992) and the motivation that comes from self-directed learning (Barrows, 1989)

PBL strategies have been implemented within the Shenandoah University Program in Occupational Therapy (SUPOT; Winchester, Virginia) entry-level graduate curriculum in two primary ways. First, the initial three semesters of classes are structured around student tutorials (i.e., discussion groups of 9 or 10 students who meet with a tutor group leader and who then seek out information and hypothesize about case-based scenarios). The scenarios are typically written or adapted by SUPOT faculty members to meet specific content objectives and to foster a developmental sequence of clinical reasoning. Second, a learner-centered, inquiry-based approach to content and knowledge acquisition is increasingly used within all learning activities across the curriculum (Barrows, 1989).

PBL can be implemented as an overall guiding design or via incorporation of PBL-based strategies, such as case-based tutorials (Royeen & Salvatori, 1997; Stern, 1997). PBL was implemented as a guiding design across the SUPOT curriculum on the basis of the following philosophical assumptions described by Schmidt (1983), Albanese and Mitchell (1993), and Barrows (1989):

- Current learning is affected by past learning. Students use knowledge they already possess to understand and structure new information. To be successful, the instructional method must activate this prior knowledge. Well-written problems will activate students’ prior knowledge.
- The closer the resemblance between the situation in which something is learned and the situation in which it will be applied, the more likely it is that transfer of learning will occur; this is referred to as encoding specificity. PBL problems use real-life situations. Well-written problems are those that present situations most commonly seen in practice.
- Information will be better understood and remembered if there is opportunity for active elaboration on the part of learners. Providing opportunities for elaboration is one of the key components of PBL (Albanese & Mitchell, 1993).
- An effective clinical reasoning process is needed to hone problem-solving skills, such as hypotheses generation, self-inquiry, data analysis, problem synthesis, and decision making, and can be developed via PBL (Barrows, 1989).

The effect of PBL on student performance has been studied in medical education. Williams (1992) showed that students in PBL programs do not perform as well on outcome tests of basic science knowledge than students do in traditional medical education curricula; the students are more likely to believe that they are deficient in basic science content. Notably, medical students entering PBL programs initially experienced difficulty with the lack of structure compared with their past educational experiences (Lucero, Jackson, & Galey, 1985); however, student stress was reduced after an initial period of adjustment (Kaufman et al., 1992).

Freidman et al. (1990) summarized PBL effects as increased sensitivity to individual patients, interest in general practice, sensitivity to context (physical, cultural, social), ability to work in a team, ability to access information and to keep up with the literature, and improved overall student satisfaction. In a meta-analysis of research conducted from 1982 to 1992, Albanese and Mitchell (1993) found PBL to be more nurturing and satisfying for medical students than traditional programs.

In this report, we describe and evaluate the use of PBL within a professional occupational therapy education program and focus on the experiences and perspectives of students as they participated in PBL during a 2-year period. The guiding research questions were:

- How do students describe their learning process and strategies in a PBL approach?
- How do the process and strategies differ from a tra-
In each group, three second-year students were randomly assigned to the roles of group facilitator, note taker, and audiovisual recorder. Because SUPOT used a participatory action research approach (Reason, 1994; Whyte, 1991) in which all faculty members and students are actively involved in implementing and evaluating the PBL curriculum and bringing about change, these second-year students learned how to design qualitative program evaluations and apply their skills within this program evaluation. In addition to participating in a qualitative research course, the facilitators were given additional instructions and training on how to run the focus group by two faculty members with focus group experience and were given a script for beginning the group and engaging in the four open-ended program evaluation questions (see Appendix) followed by a series of probes detailing stories of specific experiences.

The role of the facilitator was to introduce the questions, to summarize answers on a large white pad, to clarify and prioritize important points as agreed on by the group, and to encourage active participation by all members. The facilitator did not answer questions or participate in the content discussion but rather assumed the role of outside evaluator and clarified this role with focus group participants before starting.

Each focus group was audiotaped, and those audiotapes were transcribed verbatim by an outside consultant. References to student names and personal identifiers were removed. Some groups were videotaped during the first session; however, this method was discontinued because of student concerns about anonymity, and videotape was not used in the data analysis.

Data Analysis
Each of the seven faculty members used a constant comparative approach to code two group transcripts for emerging themes (Glaser & Strauss, 1967; Lincoln & Guba, 1985). All transcripts were coded separately by two of the faculty members with qualitative research experience. Codes were then separately summarized by these reviewers to triangulate the analysis and review processes. The coding process, portions of the raw data, and summary results were then shared with and critiqued by second-year student participants within their qualitative research course. This member check was conducted to verify the trustworthiness of the interpretations made (Lincoln & Guba, 1995). An audit trail of program evaluation decisions, activities, and outcomes was kept throughout the process.

Results
Major themes identified were related to the definition and key features of PBL, differences in learning strategies between
PBL and prior learning experiences, challenges and weaknesses of the PBL approach, and the relationship among PBL, clinical reasoning, and occupational therapy practice.

Definition and Key Features of PBL

Participants explored the student role, the faculty and staff member roles, the curricular structure, and the general philosophy of PBL. Students repeatedly described themselves as actively engaged, self-directed learners:

You have to go and find the information, so you’re learning the whole process; they’re not just throwing it in your lap and saying, “This is the question and this is the answer.” You have to go and find out where to look for the right answer and come up with it on your own. It’s a tool you can take with you.

Students described the need to learn new ways to become more effective and efficient time managers when gathering and prioritizing informational resources and when integrating new information with previous knowledge and experiences. This information management resulted in a feeling of ownership. As one student stated:

I feel like I own that information in a whole different way in problem-based learning just because I am constantly integrating and seeing how it relates to other things as opposed to having it separated off as subjects.

Students defined the role of faculty members, tutor leaders, and clinical supervisors as facilitators:

I think mostly they’re here to guide our learning process in a positive, helpful direction rather than to…to sit and lecture to it. They’re there to point you in a direction maybe that you didn’t think of or to keep you on the right track instead of wasting a lot of time going off. They’re also not the leader of the group. They really are a facilitator. We, as a group, are responsible for what we do.

Students repeatedly defined the PBL philosophy as a process:

To me, problem-based learning is the process that you go through to come up with the solution or the answer that you’re looking for. You’re never going to know all about one patient because each patient comes from a different social sphere, a different culture, a different gender, and they’re always in a different context, and you’re going to be treating different contexts. So problem-based learning enables you to go through the process and know where you need to go to find your resources and find out information so you can find the definitive answers you need.

When asked how their learning compared with their feelings about prior educational experiences, students reported that PBL involved less memorization of facts coupled with increasing application, synthesis, reinforcement, and monitoring of comprehension. Students reported that they were weaker on fact recitation and stronger in applying facts to a specific situation or issue, which supports Williams’s (1992) findings.

Learning Strategies in PBL Versus Traditional Curricula

When asked, “How have you changed your learning strategies to participate in PBL?” and “What are you doing differently from in the past?” students responded: “It’s learning over again, almost, like, learning how to learn again,” and it is “starting from the outside in.” They reflected that learning is a lifelong process: “It’s just, I can’t get enough now. I want to learn everything, and if I don’t know it, I’ll look it up…It’s a chain reaction. It’s like an addiction.”

Students reported spending extensive time seeking resources and assuming a resource coordinator role. As one student reported, “Well, the time consumption is a lot different. For problem-based learning, it’s looking stuff up and researching it on your own and talking to other people in your class about it—what do they think?”

The students managed more and different resources, including publications, people, professional organizations and groups, databases, and computer-based sources of information from within and outside occupational therapy. They used texts differently as one of many resources rather than as “bibles.” They spoke of developing strategies to integrate material from classes, tutorials, and independent research to focus on the most important or relevant material:

I’m reading on a more global perspective to seek understanding, to grasp the basic premises…rather than minute details…don’t take notes like I used to from my readings. I more or less highlight.

When asked, “How do you study differently?” three students said that PBL was no different for them in terms of study habits. Of the majority who cited adoption of different strategies, they talked of adjusting to the idea that “there is no one right answer” and trying to constantly study to justify and ground answers in critical reasoning on the basis of existing information and synthesized critiques.

Students discussed the need to adapt their styles of learning. Individually, they attempted to develop a style that focused more on inquiry and intuition. One student described participation in the program as “competition based on cooperation,” with groups of students depending on each other to learn. Group studying helped students to learn from teaching others in a peer tutor or mentor role:

When I’m doing my research for a tutorial, if I was just doing it for myself, I might slack off. But I know that I have to, like, teach other people…so I might stay in there a little bit longer, get a little bit more information than I normally would, and that’s a good thing.

This mentoring occurred between the class cohorts as described by this second-year student speaking to the first-year students in the group:

There’s a file drawer started with articles and…you can use our resources. I’ve got notebooks full of paper, probably some of them I haven’t even read yet…I’ve got books from home, you know, extra resources.

Group sessions, especially tutorials and small study groups, served as a way to justify and verify information and to develop professional behavior and communication skills as reflected in this focus group conversation:

Student 1: And I think all these groups and the tutorial and everything helps you to become really comfortable—

Student 2: Even just talking in front of another person—

Student 3: And expressing what your ideas are.
Students reported a change in their test studying habits as reflected in the statement, "You can't just cram the knowledge base in the night before and expect to be able to think the whole thing through. You've just got to keep building on it."

Students spoke of tests as learning experiences in and of themselves. As one stated, "The way they test is the biggest example of all...they give us a case and you have to think through that case and think about everything you know about each thing and apply just any kind of knowledge that you have about that." One student reported, "I think the goals are different. The goal in our past learning was to get the A where the goal here is to get the knowledge." One student reported, "I know about each thing and apply just any kind of knowledge.

**PBL Challenges and Weaknesses**

A common theme related to the challenges faced within the PBL approach was summarized as "I don't know what I know" and "I feel the more I know, the more I don't know." Students stated that they did not get final answers or enough feedback to determine what might be the "best answer." They described being "left hanging," which led to frustration in not knowing whether they were focusing on the most important or critical facts and issues:

You know one thing that I’ve heard repetitively and I know that I felt this way was...you don’t get closure on anything, you don’t know all the answers, you don’t know how deep you’re supposed to go. But no one’s going to be there telling you all this while you’re out there. So, I think we’re frustrated, but it’s really preparing us for real life.

On the other hand, too much structure or closure too soon on the part of some facilitators was cited as an issue:

There are those tutors that give too many answers, I think. They facilitate too much...and give their opinion a lot. You know, say we’re in the middle of thinking about it on our own, and the tutor will step in and say, “Well, this is how I’ve done it” or whatever, and we haven’t even gotten our opinions out yet. It happens a lot.

Ambiguous feedback given to students regarding instructor, course, and assignment expectations was cited as an issue. One student questioned whether this ambiguity was a PBL strategy to have them assume more responsibility or due to uncertainty on the part of the instructor on implementing PBL:

There’s a lot of ambiguity, and I think sometimes they do it on purpose so that we will go ahead in problem solving. But I think sometimes...that either our professor isn’t really quite sure what they want, or they’re not sure how to articulate what they want, or there’s a breakdown in communication somewhere along the way.

Several students discussed becoming more comfortable with ambiguity as they continued in the program, which supports findings from medical students’ experiences (Kaufman et al., 1992), and as they perceived that faculty members themselves became more comfortable with implementing PBL.

Students repeatedly discussed problems with not being able to readily access information resources relevant to their learning coupled with ongoing expectations to not only find, but also integrate this information into their learning:

Student 1: It’s so hard to do research. It’s frustrating to find so much information and realize you can’t access any of those materials.

Student 2: Yeah, you spend too much time looking for it, “Oh, this would be great, but I can’t get my hands on it.”

Student 3: Yeah, it’s frustrating when you are taking the initiative to problem solve and to get the information on your own and take that responsibility seriously and then find that there’s nothing after 3 hours in the library or a meaningless article that you read because you feel like you have to bring in something.

Several concerns were expressed relating to the extensive use of group work and whether it was the best strategy for them to use at critical times in the learning process:

Student 1: It’s easy for me to discuss things in groups, but it’s difficult for me to study in groups. I have to kind of get into my little shell sometimes.

Student 2: I have to understand it [content] myself before I can get into a group because if I don’t and then I get into a group, I get stressed out. And then you can’t interact...I feel like I’m holding everyone else up.

Students talked about group work as frustrating in terms of time management, feeling like they or others might be holding back other members, and experiencing problems with determining the accuracy and validity of other group members' comments.

Finally, three students expressed concern about the issue that SUPOT was not following a comprehensive PBL approach, akin to Barrows’ (1989) taxonomy, specifically regarding lectures versus student-led discussions:

It’s my understanding with pure problem solving that there’s not tests or lectures at all...Problem-based learning...is...like, tutorials where they give you a case or give you a situation, and then you have to find out about it yourself, so there would be no lecture or anything involved.

**The Relationship of PBL to Clinical Reasoning**

The final themes related to the topic of clinical reasoning and students’ perceptions of the construct of clinical reasoning within occupational therapy and its relationship to the PBL approach. When asked, “What is clinical reasoning?” students defined it as a process to solve problems or to figure out something that involves the following skills:

- Pose questions and select most important or relevant points from a case or situation
- Decide where and how to get critical information to support the process
- Bring the information back to a group of peers to process
- Share and brainstorm how the information applies
to a given case situation and context
- Think out loud about your reasoning for the case or issue
- Deal with not being necessarily “right” but still sharing thoughts
- Engage in group problem solving and decision making
- Integrate past life experiences, knowledge bases, and research into problem solving
- Consider multiple factors and perspectives in formulating plans of action

Students generically described clinical reasoning as a rationale for all we do as occupational therapy practitioners, as a way to understand patients as persons, not just cases. Several expressed confusion regarding the difference between PBL and clinical reasoning. One student exemplified the view of PBL as a groundwork for developing clinical reasoning:

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\ldots \text{through the cases that we have. You have to clinically reason why we do things—why we're going to apply certain theories, why we're going to apply a certain technique, why we're going to devise a certain treatment plan, what's our reasoning for that. Isn't that problem-based learning?} \\
\ldots \text{But I think clinical reasoning is taking what you've learned in problem-based learning and being able to apply it to each individual person and a person as a whole, not just a diagnosis or a disability.}
\]

They summed up the importance of developing clinical reasoning skills and PBL's connection to this by stating, "Life is not a cookbook, and you can't take a cookbook approach to it. You need a curriculum that doesn't only offer cookbook answers and need to look at clinical issues more holistically."

Discussion

Many of these themes support and expand on findings from prior PBL research in other disciplines and programs. Although students had not yet practiced as occupational therapy practitioners, they were able to identify the effect of PBL on the development of professional-level competencies outlined by Bruhn (1992) and O'Neil (1993), including teamwork, information management, lifelong learning, diversity sensitivity, and self-organization and self-management. In her study of student perceptions of PBL, Stern (1997) reported communication and teamwork benefits within the context of one case-based course. Within SUPOT, the integration of PBL philosophy and learning strategies across the curriculum was designed to allow students to practice Bruhn and O’Neil’s identified professional-level competence over time and to continually reflect on their current competence and future needs.

In particular, information management and resource coordination were repeatedly discussed as key underlying skills that were honed throughout the curriculum, although limited local resources presented continual frustration. The extensive time needed to find and manage information and the ability to flexibly shift in and out of different roles (e.g., student, teacher, researcher, informed consumer, social support) imposed by the PBL approach were identified as challenges by several students. This challenge has implications for any program that attempts to incorporate the PBL approach with its intensive learning strategies into the curriculum. Although SUPOT students received orientation training before starting the program, it appears that additional experiences are needed to model flexibility and time management skills, perhaps sponsored by graduating students who have been through the program or practicing clinicians who have many adaptive coping strategies to share. Additionally, as Internet-based information and entire text references become increasingly available, emphasis must be placed on how to critically analyze the underlying tenets and scholarly rigor of information resources, particularly as applied within an occupational therapy paradigm.

According to student comments, the SUPOT PBL approach served as groundwork for integrating information with prior knowledge and experience, for applying this learning to real-life situations and contexts, and for elaborating on knowledge with other students in the roles of peer mentors, thus reflecting core PBL philosophical assumptions (Albanese & Mitchell, 1993; Schmidt, 1983). At the same time, students perceived that a PBL-based approach developed practical and applicable skills that would be further developed in future practice.

As in Williams's (1992) study and Van Langenberghe's (1988) study of physical therapy PBL students, students confirmed that they used fewer rote memorization learning strategies and believed they were able to integrate and synthesize holistically. They confirmed that they were anxious about their ability to perform on traditional, content-oriented tests that emphasized factual memorization. SUPOT students exceeded the pass rate average on the national certification examination; however, this might have been due to the fact that the examination has increasingly incorporated cases and clinically and contextually based questions.

The students' perceptions about clinical reasoning and the link between PBL and clinical reasoning is of note. In Stern's (1997) study, students believed that their PBL case course strengthened their ability to think through a situation and synthesize the issues involved, thus supporting the hypothesis that PBL strategies can serve as a framework for developing reasoning skills. Within our study, many students viewed PBL and clinical reasoning as the same process, perhaps better representing the construct of critical reasoning rather than the multifaceted, complex clinical reasoning process described in the occupational therapy literature (Mattingly & Fleming, 1994). In particular, students' descriptions lacked insight into areas related to inter-
active and conditional reasoning that may need to be developed within fieldwork and future practice.

The question of whether and to what extent critical and clinical reasoning can be developed during preprofessional educational experiences, especially through the use of intensive case-based tutorials built across the curriculum, is worth exploring in more detail within a longitudinal study as students graduate and become occupational therapy practitioners.

Cases presented and discussed within small, intensive tutorial groups were identified as the defining feature and key component of PBL, of student learning, and of professional development. SUPOT experimented with the timing of case-based tutorials held three times (for 90 min during the first year) and two times (for 120 min during the second year) per week. The optimal use and timing of these tutorials has yet to be determined, but students agreed that case-based tutorials must build and continue across the curriculum to foster reasoning and synthesis skills. A study of medical students by Hmelo (1994) showed that the PBL group had a much greater use of hypothesis-driven reasoning and a greater coherence in their case explanations. Such research is worth replicating in occupational therapy to study the cognitive development and consequences of PBL-based case study and its effect on lifelong learning and reasoning. Additionally, research is needed on the timing of group versus individual or dyad learning strategies throughout the curriculum to facilitate clinical reasoning development.

Students were divided on the usefulness of lectures and interactive discussions and clinical laboratory sessions. Several students challenged whether the SUPOT program should restructure these activities to be more interactive and student driven as recommended by Barrows (1989). Some students identified a general issue with ambiguity and lack of clarity on the part of faculty members in terms of professional and personal expectations for students within learning activities and across the entire curriculum.

Students distinguished between faculty facilitators who provided too much or too little guidance at either extreme; however, they did not identify a “gold star” facilitation style or explain how this style might change to better accommodate student needs as they transitioned through the curriculum. Students discussed the complex, multiple roles of the program instructors (e.g., facilitators vs. teachers, mentors, clinical role models) but did not discuss the amount of work or resources needed to competently perform these roles or the logistics behind the implementation of an intensive PBL approach. These logistics were studied via additional program evaluation and quality assurance strategies within the SUPOT program and should be compared with other PBL programs to further explore not only the effect, but also the viability of sustaining such an approach over time.

Interestingly, as faculty members reviewed the transcripts, several confirmed or challenged student perspectives in their personal summaries and the audit trail. For example, several faculty members were surprised about several students’ comments regarding the goal of learning as learning versus focusing on achieving a specific grade. Several faculty members confirmed that they were “learning how to learn and to teach” and that there were many times that they questioned how to implement the PBL approach and continue to ensure what they perceived to be the quality of the experience. Faculty members discussed their dilemmas regarding balancing educational philosophies and strategies with accreditation and university evaluation policies and their own thinking regarding how and at what level to incorporate PBL strategies into their teaching and their expectations for students in the program. Thus, the focus group activity was useful not only for evaluating student perspectives, but also for exploring faculty member reactions to student views.

Conclusion

Student focus groups regarding the use of PBL within the SUPOT program yielded many themes related to defining features, the roles of students and faculty members, changes in learning strategies, challenges, and the nature of the relationship between PBL and clinical reasoning. Students appeared to view PBL positively after an initial phase of adjustment. They identified the strengths of PBL as developing the student’s “ownership” of his or her own learning, the habit pattern of analyzing knowledge, and the relevance of small group tutorials in modeling what students anticipate to be “real-world practice.” One strength was perceived as a weakness, that is, the ambiguous and contextually driven status of knowledge and reasoning, especially within the changing health care system. By the second year, many students reported that they developed a tolerance and sense of competence for dealing with this ambiguity, given consistent practice opportunities that support a PBL approach over time across the curriculum rather than in a single course or module.

Findings from this study are limited because of the nature of the exploration with only one occupational therapy program across three class cohorts and the limited use of focus groups as the primary evaluation method. Although SUPOT will continue to expand on these data, the design could be expanded and replicated at other programs, including those that would classify themselves as using PBL throughout the curriculum; those only using select PBL strategies, such as case-based courses; and those that do not currently use PBL in any structured way within the curriculum. Such a replication, coupled with a framework for creating a portfolio of qualitative and quantitative program assessments to evaluate them, would allow for comparisons and hypotheses regarding optimal PBL
integration, implementation, and viability within occupational therapy educational programs. ▲

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Appendix
Guiding Questions Used Within Program Evaluation
Focus Groups

- What is PBL?
- How would you compare PBL with how you have learned in the past?
- How have you changed your learning strategies within this program?
- What is the relationship among PBL, clinical reasoning, and occupational therapy practice?

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