COMPETENCY-BASED VERSUS TRADITIONAL COHORT-BASED TECHNICAL EDUCATION: A COMPARISON OF STUDENTS' PERCEPTIONS

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ABSTRACT

As part of a participant-observation study investigating technical education in Canada, students enrolled in pre-apprenticeship refrigeration mechanics courses at the community college level were interviewed. The responses of students enrolled in a 1-year, competency-based program were compared with the responses of students enrolled in a 36-week, traditionally-delivered, cohort-based program. The results suggest that the different curricula lead to different student experiences of the content. Most notable was a distinctly perceived split between the "theory" and the "practical" aspects of refrigeration mechanics by students in the traditional cohort-based program, whereas students in the competency-based program did not seem to perceive theory and practice as 2 distinct entities. Additionally, although students in both samples described histories of language and literacy difficulties, the competency-based program participants seemed less adversely affected by these weaknesses. However, students in both types of programs viewed patience and supportiveness as crucial aspects of good teachers.

A trend in education has been the move toward competency or outcomes-based programs of study (e.g., Kuhlich, 1991). This trend seems to be a global initiative, as research investigating and discussing competency-based education comes from all regions of the world (e.g., Fretwell & Pritz, 1994; Grootings 1994; Hargraves, 1995; Stennet, 1984 Stevenson, 1992). For the purpose of this study, competency-based education is defined as or characterized by a program of study with clearly defined, concrete, measurable objectives of which every student participating in the program must have demonstrated mastery upon program completion. Often these programs also involve students working at their own rate and structuring their own method of learning in order to meet these objectives. For example, in Ontario, Canada, in 1998 the provincial government introduced a new curriculum for elementary school students. This curriculum focuses on measurable competencies that are evaluated for each student in the language arts, mathematics, and science and technology and are consistent at every school throughout the province (Ontario Ministry of Education and Training, 1998).

In adult technical education, the trend toward competency-based programming has been applauded and urged by a number of interested stakeholders including potential employers, some trade unions, licensing bodies, and some educational institutions. This trend toward competency-based education has been viewed as beneficial for many reasons, including the global standardization and licensing of trades (Hargraves, 1995). Competency-based education allows local licensing bodies to assess the skills and abilities of workers coming from different regions, thereby creating more portable workers (Grooting , 1994; Hargraves; Lea, 1995) which is important in the current climate of an expanding global economy. For this reason local and national governments support competency-based education (Hudelson, 1993). Business also appears to support competency-based education as it allows them to better understand worker qualifications and hire the most appropriate persons (Aitken, 1993; Hudelson; Lea; Philbin, 1982). Additionally, through linkages with educational bodies, skills that businesses need can be incorporated into competency-based programs of study (Aitken; Lea; Philbin). As do business representatives, some unions feel that competency-based training allows for more equitable matching of education and training with on-the-job needs (Lea).

During the last century, western education has commonly been based on a standard model which we will refer to as cohort-based. Some characteristics of this model include relatively large numbers of students moving, as a group and at the same rate, through the curriculum, physical facilities, and teachers. This model, which has been frequently used for adult technical education, has implications for administration, evaluation, and learning. Some advantages of this cohort-based model include ease of time-tabling as all students in a given cohort are at the same place at the same time. It also facilitates efficient use of teacher time as one teacher meets the learning needs of a significant number of students simultaneously. Additionally, physical facilities, such as expensive technical shops, are used efficiently in the cohort-based model as many students are using the facilities at one time. There is also evaluation efficiency as tests and exams can be administered in a large group format. However, despite clear efficiency advantages there are also disadvantages to the cohort-based method. As the model is designed specifically to service students in groups, individual learning needs may be neglected (Glendenning, 1983; Lee, 1984). This can be a particular problem, in vocational training, where adult learners bring a wealth of different experiences and skills to the classroom (Knowles, 1980; Knowles, Holton & Swanson, 1998; Simon, Dippo & Schenke, 1991).

In theory, competency-based education better meets individual learning needs. Such a program can be more easily tailored to meet students' strengths and weaknesses with flexibility in determining a student's needs (Glendenning, 1983; Lee, 1984). Students have greater control of the method of learning and the pace at which they learn (Lee). Additionally, because evaluation is more individualized, assessment can be more closely linked to what is required, rather than being restricted to easily marked tests (Baron & Wolf, 1996). Particularly important, with respect to adult technical education, is the opportunity for students to receive credit for previous experience and knowledge through a prior learning assessment (Ontario Ministry of Education and Training, 1993).

Despite theoretical arguments, little is known about whether competency-based education does function to provide these benefits. One study, at the community college level in Canada indicates that students view competency-based education positively (Reynolds & Sharpe, 1992). However, the limited research available suggests that teacher perceptions of competency-based education have been somewhat negative (Cornford, 1997; Reynolds & Sharpe). Cornford reported that teachers experienced pressure to pass students despite questionable student mastery, and that

they also experienced difficulty with implementing the competency-based programs due to limited resources.

Other criticism of competency-based education includes the artificiality of breaking complex tasks into separate chunks. Blunden (1996) argues that operationalizing complex and/or abstract tasks into measurable discrete units can trivialize the craft inherent in many tasks. Additionally, the behavioral nature of competency-based education is viewed negatively as it does not foster the development of broader skills necessary for citizenship (Evans, 1995; Gonczi, 1997). Some authors conclude that competency-based education is likely more suitable for vocational education than for other forms of education such as teacher training (Dhillon & Moreland, 1996; Pennington, 1994)

More needs to be known about the effectiveness of competency-based programs for adult technical/vocational education if educational institutions are going to make the expensive shift to this type of program. At present, little research exists on this topic, and to our knowledge no research exists comparing two adult vocational programs designed to deliver the same material using either a competency-based or a cohort-based model. Thus, the purpose of the current study is to compare the perceptions of students in a competency-based pre-apprenticeship program with those of students in a more traditional cohort-based program in order to determine in what ways the type of curriculum design and delivery influences student learning.

METHOD

PROCEDURE

The current study was part of a longitudinal, primarily ethnographic study of technical education in Canada. The study reported on here was informed by an earlier survey of 200 people enrolled in the educational component of various Canadian apprenticeship programs (Bell & Goldstein, 1993). This larger study, including the large scale survey, informed the specific interviews conducted in the current study. That is, areas to be explored in the in-depth interviews were selected based on the preliminary information gathered in the survey of apprenticeship students.

Participants in the current study took part in individual interviews held at their respective colleges, usually in the cafeteria or an empty classroom. The interviews were semi-structured in that certain broad areas of questioning were covered during all student interviews. These broad areas included language background and cultural, educational, and employment history. Other broad areas of questioning focused on perceptions of the program, including strengths and weaknesses; areas of difficulty; test taking; reading; note taking; and preferred teaching styles. Issues of classroom culture, including issues of equity, and any suggested improvements for the course were also included in the broad areas of questioning. Within these broad areas the flow and content of the interview was determined by the student responses. Interview length varied from 30 minutes to 1-hour depending on the individual. All interviews were tape recorded and later transcribed in full.

SETTINGS

Participants were drawn from two community college, pre-apprenticeship programs in refrigeration mechanics.

    The Cohort-Based Program. As noted in the introduction, it is important to keep in mind that the cohort-based program involves many key features, including, large class lessons, group/

curriculum driven pacing of content delivery, and a rotating schedule with distinct lecture style classes in various subjects and hands-on shop time. The name "cohort-based" may not adequately convey all the important features of this program style.

The cohort-based program was located in a college in a large urban center in central Canada. The program was 36 weeks in length, divided into six 6-weeks blocks, and included lecture-style lessons in a classroom setting as well as structured, practical activities engaged in simultaneously by all class members in a shop setting. At any one time, six cohorts were proceeding through the program. The cohorts were staggered in such a way that a new cohort started every 6 weeks. Each cohort initially consisted of 30 members of whom typically a little more than half would complete the program on schedule.

Each cohort had a primary teacher who conducted theoretical lectures in the principles of refrigeration mechanics as well as the shop classes. These teachers were hired on the basis of their many years of practical experience as qualified refrigeration mechanics. Their teacher training consisted of brief, infrequent in-service sessions offered by the college. Support classes within the program, such as mathematics and business skills, were taught by other college faculty.

Within the cohort-based program, students received instruction as a large class both in technical skills and in various relevant theoretical disciplines (e.g., mathematics, electricity, English, refrigeration mechanics). Student evaluation was based primarily on performance on written tests and practical assignments. Theoretical and practical skills were evaluated separately.

The Competency-Based Program. The competency-based program was situated in a community college in Atlantic Canada. The competency-based program had one teacher who was responsible for all aspects of program content and process. This teacher was a licensed refrigeration mechanic with many years of both practical experience and experience on professional and government committees pertaining to his trade. The teacher was assisted by a laboratory assistant who looked after the equipment and assisted students in the shop. There were 20-25 students enrolled in the program at any one time.

The physical plant of the competency-based program included a library which contained some journals, textbooks, and a few computers; a classroom; and a shop in which various tools and equipment were available for practical work.

The program participants had to complete 115 concretely-defined learning objectives. Students worked at their own pace to complete the objectives. Each objective involved both practical skills and theoretical knowledge. Upon completion of each objective students would be rated by the teacher on their mastery of the given objective using a 5-point rating scale. Students had some flexibility in choosing the order of the objectives they completed and were able to obtain credit for previous experience in that they could quickly complete the objectives that emphasized skills and knowledge learned previously. A few times a year, the teacher would conduct full class lectures on important topics and very infrequently students would do large class projects and/or presentations. The program also involved a minimum of 2 weeks of on-the-job training. Although students worked at their own rates to complete each objective and had flexibility in the scheduling of their on-the-job training, the vast majority of students were actively participating in the program from September through May.

Participants from the cohort-based sample were drawn from two classes of approximately 25 students each. Roughly 5% of class members were female, and the ages of participants ranged from 18 to 60 years. Students had a wide variety of educational experience. Roughly half had graduated from high school, and roughly one third had previous post-secondary education. Students also had a wide range of work experience. Not only was there variety in employment experience between the different students, but individual students often had a wide range of work experience. While some of the students had just left high school, the experience of the others included restaurant manager, architectural secretary, steam fitter, painter, teacher of Somali language, retail salesperson, furrier, and building maintenance person. Within the cohort-based sample, roughly 20% of program participants were members of visible minority groups. Approximately half of the students had a language other than English as their mother tongue, although approximately half of this group had completed all of their education in English.

Competency-based program participants were members of a class of approximately 20-25 students. All participants were Caucasian males. For the vast majority, English was the first language. Roughly half had completed high school, and approximately 10% had additional post secondary education. A significant number of participants in both samples were currently unemployed and/or receiving some form of government-funded social assistance.

The two cohorts that comprise this study are clearly situated in different social, cultural, and economic contexts. The mother tongue and cultural diversity differences are attributable to the location of the two programs. The cohort-based program is located in a large urban center in central Canada, while the competency-based program is located in a rural maritime town. Inevitably, some of the issues that face each cohort are distinct. At the time of data collection, the Atlantic Canadian region was experiencing profound economic difficulties with the historically primary industry of fishing having been virtually eliminated. Additionally, given the small population and industry base, opportunities for employment in the training field upon program completion were quite limited. However, socio-economic data gathered from both cohorts indicated that the people enrolled in both programs possessed similar levels of education and occupational experience and had similar income levels. Many of the individuals in both cohorts were receiving some form of social assistance when this study was conducted and had been selected for program admission on that basis.

RESULTS

The results have been organized and presented as the five most salient themes which emerged from the interview transcripts.

PERCEIVED DISTINCTION BETWEEN THEORETICAL AND PRACTICAL KNOWLEDGE

In the traditional, cohort-based program all students commented unfavorably on the split between the theory and the practical parts of the course. The split was profoundly felt by all students interviewed. Typically, they indicated that practical activities were valued as supporting their espoused career goals. Theory, however, was seen as an unnecessary obstacle imposed on them by "academics" who had no understanding of what it meant to be a practicing refrigeration mechanic. One student stated "teachers should teach what is done out in the field . . . . the good teachers are those who know what it is like out in the field . . . . we don't need those who teach

like university professors." Additionally, a catch phrase voiced by several students in their interviews was "an ounce of practical is worth a pound of theory."

The split in students' perceptions between theory and practice was evident in their comments about what portion of the course they found difficult. Those students with some practical experience (approximately 75%) tended to find some aspect of the academic or "theory" course components challenging. A male in his 20s summed up the frequent feeling about theory.

> Interviewer: "What have you found to be the most difficult part of the course?"

> Student: "The theory. Because the practical, it's simple for me. But the theory, you have to go through the book and read, and you got to understand what you're reading. It's kind of hard, the theory."

Those students with stronger academic backgrounds tended to have limited practical experience and had difficulty in shop. For example, a male in his 20s said,

> I felt, when I came down into the refrigeration shop this block, it seems that the teacher sort of figured everyone knew what was what. Saying, 'you got to use a t-yoke or a yoke'. I had no idea what it was.

A female student in her 40s experienced on-going difficulties, including difficulties in shop. She was considering leaving the program and talked about her reasons for considering quitting.

> Well, it wouldn't be because I felt I couldn't handle the academics. And it wouldn't be I felt that I could never learn to do this stuff in shop. It would be because of frustration. It would be frustration for the teacher because I can't drag the knowledge and the understanding out of him that I want to get. And the shop is just a bad experience. One long bad experience.

Within the competency-based program, the language of two separate entities was not used to describe the difference between that which was considered "theory" and that which was considered "practical" by any of the students interviewed. Students in the competency-based programs did not discuss theory and practice as distinct from one another nor did they seem to view one as being more valuable than the other.

As an illustration of the theory/practical integration that is evident in the competency-based program, one young male student just out of high school commented on an end-of-the-year project he had just completed.

> The project was good that he [the teacher] assigned. We were asked to do a project, ventilation for a home, duct size, do the complete project. Did you see it? It gave everybody a chance to do a little bit of hands on, a little bit of drafting skills, and a little bit of figuring out duct sizes. Gave everybody something to do and they could do it at their own pace.

Another student in the competency-based program described the reading of trade journals by students in the program, which also seems to indicate a melding of the theoretical and the practical with no evidence of a perceived separateness between the two.

Oh yes, we have HVAC News, we have HVAC Heating and Air Conditioning, we have Mechanical, several different nationally-renowned publications in Canada and the U.S. that we subscribe to here. Often times you'll walk into class and you'll see the guys reading them, whether they are reading the articles or whether it be the classifieds at the back where they show jobs listed, or just looking at the new products. . . .Also [teacher's name] always draws our attention to conferences.

Another competency-based student, when asked by the interviewer "Do you think the balance between the theory and the practical stuff is about right?" replied, "Yeah, it's basically up to yourself. If you don't feel you know something, you can go down to the shop and work on it."

Finally, a young male in his late teens who completed grade 10 in high school described how the knowledge he attained in school linked with his on-the-job training.

My first on-the-job training, you don't really know what to expect . . . . Then when you get out there it's all hands-on, you just got to have the knowledge inside to do the hands-on.

These descriptions do not indicate a difference between theory and practice existing in the minds of the students, and it may be hypothesized that the program design shapes the perceptions of students in the cohort-based and competency-based programs.

Important Student Characteristics

In addition to shaping student views of the theory and practice of their discipline, it appears that curriculum design influences what personal characteristics students deem important for program success. These identified characteristics reflect differing views about who is responsible for student learning.

In the competency-based program, the student characteristics deemed by the students to be essential for success in the program included motivation, initiative, and maturity. Comments from the competency-based students which illustrate their perception of the need for self-direction include the following from a student who finished all his competency-based objectives before the other students and was being questioned on how he had accomplished this.

I've done a lot of studying away from class, too. I hit the books at home. I was at the books all over March break. I don't know, I think this course is as good as you want to make it, you know.

Similarly, from a 21-year-old male who had recently finished high school,

When you go to school you got to show some discipline to read and do your own notes and study for a test, that's how it's supposed to be done.

And from a man in his early 40s hoping to change occupations,

This is like any other school program. At the end of the year, you can take a test and pass your test and walk out, and you haven't learned anything. It's up to you what you want to get out of it.

These characteristics suggest that the necessary attributes for success lie within the student. On the other hand, in the cohort-based program, the student characteristic which was emphasized repeatedly as essential was previous technical/mechanical experience or ability. Thus, students' current actions were seen as secondary to past actions in their impact on learning and success in the program.

In the cohort-based programs, the most common suggestion for necessary student skills was practical knowledge/hands-on experience. Illustrations of this belief include the following:

> I think there should be a stricter mechanical aptitude test to get into this course because there are a lot of people with academic smarts, but their mechanical ability is pluhhhhhtttt . . . . forget it!

> There are a lot of students in our class with no mechanical aptitude whatsoever. It starts to show half way through the first semester. There are 3 or 4 who shouldn't have passed the first block because their skills are so bad. Should never have passed it.

Based on the first author's experience as a participant-observer in the cohort-based pre-apprenticeship program, we believe that this student suggestion ties in to the valuing of that which is "practical" and the devaluing of things "theoretical" or "academic" and has an aspect of passing judgment on those without previous practical experience. Personal experience in the program, with little previous hands-on technical knowledge or experience, suggests that it was quite reasonable for a person with such limited experience to learn the necessary hands-on skills.

In the competency-based program, students seem to perceive program success and learning as under one's own control and a product of a strong "work ethic." On the other hand, students in the cohort-based program seem to view success as contingent upon previous experience and/or natural endowments such as aptitude. One possible explanation for this finding is that perhaps the structure of the cohort-based program is more like previous experiences of school in childhood, where many of the participants experienced limited success, and hence the value of being in charge of one's own learning is not communicated effectively.

LITERACY ISSUES

Many of the difficulties expressed by the students in both the competency and cohort-based programs were in the realm of language and literacy. Despite the mother-tongue differences between the cohort and competency-based students, their literacy concerns were remarkably similar. The students had similar levels of education, and questioning about academic history revealed similar difficulties with academic pursuits in general and literacy skills in particular. Such historical and current literacy difficulties included difficulty with understanding the textbook; difficulty taking notes, both from lecture and the text; and difficulty with the tests, both in preparing the appropriate (most important) material and understanding the meaning of test questions. More than half of the students interviewed expressed difficulties in at least one of these language-focused activities.

One student in the cohort-based program complained of being unable to process the required information in the time allotted.

> I think they go too fast. I think that there's so much material that they're just touching on. I can't hardly blame them because they have to pump out, every 36 weeks, they've got to pump out 20 people, or whatever the case is.

A male student in his 20s in the cohort-based program, who spoke Greek at home before he started school in English, described his difficulty understanding and integrating the textual information.

> The major problem is not so much with the text, but with the teachers, they also have their own handouts. A lot of them don't look at the text, and in not doing so, we're covering a specific chapter and they have their own material on that chapter. They'll give us handouts all saying the same thing. So we've got three to five different sources of information to get the one thing that we're after. We find that we're interchanging a lot of information and we're losing the basic gist of it in the process.

Similarly, although not acknowledging a difficulty reading the text, an English-speaking male in the cohort-based program who just finished high school said the following: "The textbook, I use it to study and that, but some of the information in there all sounds the same. I like it better when he [the teacher] explains it more." Yet another student, "Terminology, quite a bit of it in air conditioning is foreign, it's like a foreign language. I go, 'what do these words mean?'"

Language difficulties were also evident in two types of comments about tests in the cohort-based program. The first type of comment is that the teacher asked questions that were not what the students expected. For example, an English-speaking male in his 50s summed it up well. "I'm an expert in the stuff they don't ask." The second general type of test complaint dealt with unclear test/exam expectations.

> Some of the teachers have a way of wording it in a manner that you would study something and when you got on a test you say, 'What's this?' Some of them don't even tell you what's going to be on it, they just kind of say this is going to be on it, so you study all of it and half the information that you study is not on it. That's what I find with a lot of these tests.

This quotation also illustrates a way in which the design of the cohort-based program does not facilitate in the students a desire to learn the material for their own learning and knowledge. Rather, the students view the material as valuable to learn only if it is going to be asked on the test.

Difficulty taking notes both from the lecture and text, in the students' own words, was a common challenge expressed by students in the cohort-based program. Several students found themselves trying to write everything the teacher said verbatim.

> Interviewer: "Do you take notes in class?"
> Student: "Yes, yes. I'm just writing and writing and writing."
> Interviewer: "In your own words?"
> Student "Well, what he's saying. Then at night, usually before dinner, I try to decipher everything I took during class."

> "A big problem is you cannot write when he's speaking, when anyone is speaking. I'm not referring to the teacher that we have right now, I'm referring to just the broad scope. We can't really get involved in writing anything or even taking our mind off of him for one minute, because when he's talking about a specific thing, like super-heating or something that's a little more in depth, we'll lose it."

A student from the competency-based program both described and denied his history of reading difficulties in the following passage:

> During my elementary school years . . . . I used to have people read to me, just to help me learn more, one on one, individual. But no, I don't have any problem reading now, not really. . . .although before this course I never read a book in my life . . . . I read magazines and stuff but not some 300-page novel or something like that.

As in the preceding passage, despite the frequent difficulties described above, students in both programs unanimously denied any troubles with the language demands of the course and language in general. The first response from a recent immigrant to Canada from Somalia who was been described both by the professor and other students as having significant language difficulties was quite typical of all class members in denying language difficulties.

> Interviewer: "What kind of problems, if any, with the language have you had in this particular course?"
> Student: "At the present time?"
> Interviewer: "Yes."
> Student: "I didn't have any problems."
> Interviewer: "So you understand the teacher and the terminology?"
> Student: "Yes, yes. Some scientific if you don't understand it, anything relates scientific as a science, no matter what language you speak is a science, then that is question. But we understand straightforward English."
> Interviewer: "What about the textbook, have you had any problems understanding the textbook?"
> Student: "No."
> Interviewer: "So overall you feel that language is not a problem in this course at all?"
> Student: "No."

Despite the evidence of a student history of language and literacy difficulties in both programs, as well as denial of such difficulties by members of both programs, it appears that the competency-based program allowed students to better compensate for those language/literacy weaknesses, and their progress through the course was not slowed as significantly by their language/literacy difficulties. Although their words indicate weak literacy skills, they did not complain about these issues hindering their progress. It appears that, possibly, the structure of the program allowed them to learn the material despite these weaknesses, or alternatively they might have been evaluated on skills and knowledge that were not so heavily influenced by literacy skills. For example,

> Sometimes . . . . I'd be halfway through the book and I'd go out and, you get pretty lost, like when you're reading before you go on on-the-job training. Once you go out on on-the-job training, and you come back and start reading again, you realize that it's a lot easier because you know what each function of that part does.

In the cohort-based program, on the other hand, student difficulties with language and literacy are taxed in an ongoing manner by the structure of the program delivery, processing, and evaluation.

Although both samples were generally pleased with their respective programs overall, students in both programs had many suggestions for improvement. Interestingly, the most salient comments from each program asked for more of what the other program had. Within the cohort-based program, students tended to call for more integration of theory and practice, and more variety in teaching methods. On the other hand, students in the competency-based program tended to ask for more teacher-directed lessons. These comments illustrate the need for a variety of teaching methods to address a wide range of student learning styles.

Within the cohort-based program, suggestions for variety of teaching methods came from every student interviewed. The specific suggestion or way to increase the amount of practical information provided seemed to depend on the individual student. Many of the suggestions involved adding either visual displays or demonstrations to supplement the theoretical lectures. One cohort-based student said,

> . . . this course goes on long enough that they can actually afford to pick up one of these pieces or set up a unit that works and physically shows us what's going on.

Similarly, another cohort-based student said,

> In the theory they should show us more visual equipment, instead of talking about it. Like put it on the desk or something.

In addition to many comments requesting greater use of the actual objects to integrate the concrete and the theoretical, there were requests for physical demonstration within both the theory and shop lessons. In the cohort-based program, a male in his 50s, with many years experience as an industrial foreman said,

> I would give them even time on theory and practice. But physically show them. Look at . . . . this is a piece of 3/4 inch pipe, this is a 5/8 inch pipe, and get calipers and rulers and show them how to do it. I would clean a piece of copper pipe because people don't know how to solder, they really don't. I would solder with a soldering iron to start with, show them how to clean the different types of pipes . . .

A male in his late 40s in the cohort-based program summed up the request for increased use of practical visual aids.

> Show some slides you know, like in this block now and the first block, too. Give a demonstration of how something works. That's a lot easier to relate to than to a mark on the blackboard.

During our observations in the cohort-based program, it was noted that many teachers were reluctant to use teaching aids such as slides. As is documented elsewhere (Bell, 1994, 2000), technical instructors appeared to believe that "good teachers" were capable of delivering lectures without notes or slides. It was implied that those faculty members who did make use of audio-visual aids were failing to do adequate preparation themselves and instead relying on commercial props.

In addition to requests for increased practical and visual aids, a few students in the cohort-based program requested practical written assignments and problem solving. A female in her late 20s said, "I think more written assignments in class. If we are doing something then we can ask if we have questions." Similarly, a male in his 20s requested more assignments.

> . . . something you can work on at home, just to keep your mind fresh on it. They have questions in the book. They don't say to do the questions, but I guess if you wanted you could go ahead and do it . . . if you go through the questions you get a better understanding of what he's talking about.

A few students in the cohort-based program also requested that the professors write more notes on the board. For example, "What I'd like to see is a lot more notes on the board. Something like, 'what is the function of this valve?' And he puts down what the function is."

Although some cohort-based students said they would not enjoy working in a group, an equal number requested some group work or group projects.

> I feel group work would help a lot instead of doing it individually. Because sometimes if you don't know something, another member of the group might help you with what you don't know, and I can help him.

> I think group work would help a lot because you could almost, say if you had a group of four, you could have two inexperienced people with two experienced people working on the same project, and they could help each other. You'd be learning a lot more than just working by yourself.

One cohort-based student mentioned that he would like an alternative style of evaluation to the traditional, formal testing that was the norm. A male in his 50s who had been out of school for many years and was having some difficulty with the traditional tests said,

> If you had an open book concept, it would have been all right. You can look it up and it's there. On the job if you're after something, you'll have charts and all that stuff, you'll have numbers, catalog numbers, something to dig through. Here, you're pulling these things out of the air.

Several students in the cohort-based program suggested more linkage between the shop and theory portions of the course. For example,

> I don't know if it would work or not, but why not have the shop and classroom all in one room. If I went up to [teacher's name] and said 'OK, show me here exactly what's going on inside of this compressor.' He can explain it to me, but then on the blackboard, then that's where it would come together . . . I can see this compressor. This is what happens, the gas is coming through here and it's going up and it's doing such a thing.

Similarly, two additional cohort-based students stated,

> . . . the practice should be linked together with the study. So what you see is also what you do in writing. It would simplify the tests because you actually see something, you touch it with your hands.

> . . . if he's going to explain how a certain compressor or condenser, how it functions, I think we should be talking about that in the shop area.

Although it seemed to the participant-observer author that the lessons in the cohort-based program were carefully sequenced and gradually progressive, several students in the cohort-based program also discussed the need for lessons to have a logical and simple build, from basic to more complex concepts and ideas. A male in his late 20s phrased it this way:

> I think they should start . . . it's like math, one and one is two. There's no point jumping into electricity and saying this is what a parallel circuit does if nobody knows what a parallel circuit is.

One of the female students in the cohort-based program said,

> I think if I was teaching the course I would teach the same way that I think. So I would teach any concept very simply and then build it up to the level that I need to teach the students.

The primary suggestion for improvement from students in the competency-based program involved a desire for more teacher-directed lessons, both in a large group and smaller group format.

> I would like to see more of them [lectures]. I think now for refrigeration he should have so many lectures on different things, perhaps new products in the field. It should be a more structured thing where he sits down to refrigeration and takes the burner technicians and sits down with them and consults with them. And then if it was something like controls, whether it's heating or refrigeration, have the whole class sit in on it. I found the ones that he did give, they were very interesting.

> Yeah, you learn a lot [in teacher-directed lessons]. I wish he would do more of them actually. I guess you learn a lot when everyone gets together like that because anything you miss, you hear someone else talking about it in class. That's the one thing I would change, I'd have a little more classroom work, but self learning is good, too.

IMPORTANT TEACHER CHARACTERISTICS

Notably, despite different program design with respect to curriculum delivery, the students in both the competency-based and traditional, cohort-based programs had very similar views about what they wanted and needed from a teacher. Both groups of students felt that a teacher needed to be very knowledgeable about what it was like out in the field. For example, "Our teacher calls a spade a spade. He knows what is happening out in the real world." And from another student, "Teachers should know what is happening in the field."

In addition to extensive, practical experience and knowledge, both groups of students saw a good teacher as being supportive and sensitive to students needs, being patient and always available for students to ask questions, and being encouraging and providing reinforcement to students. Interestingly, both groups warmly endorsed the teaching approach of their lead instructor.

For example, when asked about what qualities are important in a teacher, comments from students in the competency-based program included the following: "Any good instructor just gives a certain amount of motivation, acknowledgement of work well done, gives help whenever possible;" "He's [the teacher] a nice guy, a reasonable guy, he seems for some reason when he talks you listen. He's more like one of the guys than a teacher. . .I wish I had had more teachers like him in high school;" "You can ask him anything. [Teacher's name] is really open like that. . .He does his best to help everyone as much as he can, he's a very good instructor. If you have a question or you have a problem, you go see [teacher's name], and he'll help you out with any problems that you have."

Students in the traditional cohort-based program described what they valued in a teacher in very similar ways: "A teacher should have time for the student, to answer student questions;" "Our teacher is calm and has the patience. You ask him questions and he never gets angry. All the teachers here were patient, but he is the most."; "Our teacher. . .he's very good. His knowledge is excellent. He's very approachable, you can approach him with any question whatsoever."; "I think he's a great teacher, he's practical and down to earth and you can talk with him and converse with him, where you couldn't with the other teachers. . .if you feel you have a problem, you can go to him and he'll help you out."

DISCUSSION

When curriculum is designed and delivered in different ways, what is the impact on students? What do students enjoy and struggle with under each type of program design? What characteristics of teaching and learning remain constant despite changes in program design and delivery? In the case of competency-based and traditional cohort-based programs of pre-apprenticeship level refrigeration mechanics, students' words illustrate the different impact of program design and also some constancies in students' perceptions of their educational experiences.

Commonalities across both types of program design include a desire for a variety of teaching methods to address a variety of learning styles, as well as the importance of a teacher's practical knowledge and human qualities including caring, approachability, patience, and warmth. These latter qualities have long been valued in teachers of younger learners, but it is noteworthy that this population of primarily adult males have similar hopes and expectations.

Differences that emerged in students' perceptions between the two program types include a greater perceived integration of the theory and practice of refrigeration mechanics in the competency-based group, as well as a greater sense of student responsibility for and ownership of learning within the competency-based program design. These differences may arguably be related to a slightly more "natural" approach to learning craftsmanship that is allowed by the competency-based program design. Skills are learned as a unit of inseparable theoretical knowledge and practical skills within the competency-based program. Evaluation strategies within the competency-based program similarly do not separate theory from practice. Additionally, in the competency-based program, if a student does not sufficiently master a skill he/she does not move on to learning a more complicated skill, so the timing of student progression is more natural. To some extent, this is the way trades have been learned for centuries. It is only the logistical demands of modern educational settings that force an artificial separation of theory and practice to allow time-tabling based around convenience and efficiency rather than mastery.

It should be noted that we submit only that competency-based design may be more natural than the cohort-based program assessed in this study. It is acknowledged that splitting complex tasks and craftsmanship into discrete packages or objectives which are measurable also introduces an artificiality to learning craftsmanship (Polanyi, 1958). Competency-based learning is not a true apprenticeship model which would allow for holistic integration of the various "units" of skill/ expertise that the competency-based model keeps separate.

It is also important to note that the competency-based format seems, based on students' word s and perceptions, to better accommodate adult students with relatively weak language and literacy skills. This is a particularly important observation given the relatively weak literacy skills of many students in college-level technical and/or job-retraining programs (Bell & Goldstein, 1993). In many ways this finding is not surprising given that within the competency-based program each student was individually able to choose the manner in which they met each learning objective. They could choose to read a text, talk to a teacher, use a computer program, talk to other students, work in the shop, or read trade journals. Thus, if they were weak in certain academic skills they could minimize their need to use these skills for learning. However, it must be noted that in many ways the cohort-based system makes much more efficient use of practical resources and physical space. The cohort-based system was able to process roughly six times as many students with similar physical plant equipment in slightly less time.

There are of course many limitations to this study that restrict our ability to draw conclusions related to the general population of technical education students. This was a qualitative study that endeavored to reach an understanding of the issues faced by some vocational students in two particular environments. As such, the performance of the individual teachers inevitably had some impact on the comments offered. The student groups were predominantly male and were drawn almost entirely from those whose educational and workforce experiences have been somewhat unsuccessful. As acknowledged earlier, the two programs were held in different locations and comments made may reflect some of the ethnic and linguistic differences of the local populations (see Bell, 2000, for a related discussion). Future work which examines actual measures of success on specific outcomes such as securing successful employment in the field is obviously indicated as this study was focused primarily on student perceptions of program effectiveness.

Despite these limitations, it appears that based on the words of the students in the courses, the competency-based style of technical education has distinct technical/competency, learning, and philosophical (i.e., theory/practical integration) advantages. An additional strength of competency-based programming includes the chance for students to receive credit for previous life experience.

Although the competency-based program appears advantageous from a student-learning perspective, it is less obvious which program is advantageous from a "human" perspective. Clearly, students in these types of programs value a supportive, caring relationship with the course teacher(s). One might speculate then that a close, supportive relationship amongst classmates might be similarly valuable. Perhaps a weakness of the competency-based program lies in the loss of the camaraderie and social support that is built into a cohort-based program through its design. Within the competency-based program students did not speak frequently of asking questions of one another, struggling together over common obstacles, or working informally and collaboratively together on common projects. The cohort-based program facilitated these social experiences; for example, students would regularly gather in groups before a test for last minute studying.

In addition to limited social interaction with other students and a possible lack of class cohesiveness, another more technical difficulty of the competency-based program includes the problem of tracking student progress as each student is working at different rates, and students may drop in and out of the program. That is, at a given point in time it may be unclear if student progress has stalled completely, or if the students are simply working at their own pace.

As well as potential social advantages, strengths of the cohort-based program include a mode of teaching and learning that is familiar and comfortable for most students educated in a Western culture. Students become socialized to learn a certain way and are commonly most comfortable with the familiar. Administrative advantages of the cohort-based program include ease of scheduling, allocating space, and tracking/evaluating student progress.

In summary, based on student perceptions, it appears that from the perspective of the learning of specific content, taking ownership of one's own learning, and developing an integrated view of the theory and practice of a specific discipline, competency-based programs have many advantages over the cohort-based programs. From the perspective of efficiency and possibly social/group process and camaraderie in addition to content learning, the cohort-based program may be advantageous. Commonalities, regardless of mode of program delivery, include student appreciation for a warm, caring teacher as well as a need for variety in teaching methods to meet students' learning needs.

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