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5 Ladders of Active Learning: An Innovative Learning Steps in PBL Process

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Abstract

University Tun Hussein Onn Malaysia (UTHM) has decided since 2005 to fully implement Problem-based Learning (PBL) in teaching and learning. Since then, PBL has become the major teaching and learning approach among lecturers and students. However, some problems were reportedly faced by the students and the lecturers due to the lack of proper instruction provided for the students. A number of steps have been taken to overcome these problems. One of the main steps is to design and implement a proper learning instruction and module. The module is an innovative invention comprises a comprehensive learning system and a practical step by step learning process called 5 Ladders of Active Learning. A study was conducted on the implementation of this new innovative PBL learning process. 148 students from 4 faculties were selected to be the respondents. A set of questionnaire was developed and distributed to the respondents at the end of semester. The data were collected and analysed using SPSS application, and reported in form of mean score and percentage. Finding shows that students highly appreciate the introduction of 5 Ladders of Active Learning and it was seen as highly effective in improving their PBL learning experience. However they were also suggested that 5 Ladders of Active Learning be incorporated into a comprehensive learning system including with the incorporation of interactive learning materials and paperless learning initiative. Thus, further studies focussing on the development of a comprehensive learning system with the incorporation of interactive learning materials and paperless learning initiative is highly recommended in the near future.

Keywords: Problem-based learning, 5 Ladders of Active Learning, UTHM, Malaysia;

1. Introduction

Problem-Based Learning (PBL) is an educational strategy where learning is driven by a problem and students work in teams to learn more about the problem, conduct a research, communicate to each other, apply many essential skills and enjoy the fruits of active learning. The lecturer or teacher is not the one who controls the learning process. Instead, he or she plays the role of a facilitator and motivator to guide the students along the learning path (Savin-Baden & Major, 2004, Savin-Baden, 2003). PBL has proven to be a successful educational strategy in many different study domains all over the world and it was used as a strategy for development in the globalized higher education (Kolmos & Graaff, 2007, Du, Graaff & Kolmos, 2009). Because of its popularity, PBL has been accepted as one of the most powerful student-centered learning approaches that enable many institutions to make a significant change in teaching and learning approach. Some institutions have been successfully adopted PBL and their faculty members and students have enjoyed the benefits from the adoption.

Unfortunately, there were also some cases of ineffective PBL adoptions in which the approach was seen as incompatible, rough and burdensome to lecturers and students. The ineffective adoption of PBL has developed some bad reputations and people are stereotyping PBL into a "short cut" for easy way of teaching. PBL is seen as a fairly unstructured approach to teaching where the lecturers or teachers, after giving a problem or problems will immediately let their students work by themselves without any guidance and proper observation. That is not really a good practice and will not guarantee the successful implementation of PBL anywhere in the institution. A true PBL practitioner will always take into consideration a proper planning and they always do. Hours of up-front planning and preparation will take much of their time and energy so that what may seem to be a spontaneous student activities during PBL session are in reality a carefully planned component of a structured learning plan, with a clear educational outcomes in mind.

2. Learning process in PBL

For many years, a novice PBL practitioner will embark on "try and error" PBL exploration in which they have to face problems and challenges before finally come to the conclusion on the best PBL practice that suits their needs and the learning styles of the students. One of the most challenging parts in PBL implementation is to find the right way and proper learning process to be introduced in a selected course or topics. Many higher learning institutions have introduced their own PBL learning process and were then shared and imitated by other institutions. Unfortunately, there is no single PBL learning process that fits all. Lynda (2004) has listed more than ten PBL learning processes practiced at higher learning institutions from various parts of the world. As many years have past, the number is increasing and the PBL learning process becoming more structured and often was designed specifically to meet the demands and standard at particular institutions and for a particular subjects or courses. For instance, Temasek Polytechnic of Singapore has introduced and implemented "Seven Stages" of PBL learning process. At Republic Polytechnic of Singapore, the students solve one problem a day and the PBL process comprises three meetings for the

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students to work together and come to the pinnacle of the PBL learning (O'Grady & Alwis, 2002). Other institutions were also having their own format of PBL learning process. Table 1 shows varieties of PBL learning process practiced at selected higher learning institutions across USA, Europe, Australia and Asia (Lynda, 2004). The learning steps in PBL process as shown in the table are between 4 to 9 steps. This does not mean that the lower is the better or vice versa. It only shows the varieties of PBL process as adopted by each institution. Some steps were common among institutions and some are unique for their own needs and learning environment.

Table 1. Varieties of PBL Learning Process

No.	Institution	Steps in PBL Learning Process
1	Faculty of Dentistry, University of Hong Kong	4
2	Gimmer University, UK, (Bachelor of Science – Mechanical Engineering)	5
3	Stanage University, UK, (Diploma in Social Work)	5
4	University of South Carolina	6
5	Samford University, USA	6
6	Lembert University, UK, (Bachelor of Engineering in Automotive Design)	6
7	Northern Arizona University	7
8	University of Sewanee, USA (Teacher Education)	7
9	Maastricht University, Netherlands	7
10	Queensland University of Technology, Australia	7
11	Mcmaster University, Canada (Chemical Engineering)	8
12	University of Newcastle, Australia, (Bachelor of Construction Management)	9

PBL is not a "one size fits all" methodology and it is more of a philosophy and approach that emphasizes the effective use of problems through an integrated approach of active and multidisciplinary learning (Oon Seng, 2003). As such, the learning process designed by any institution should reflect the integrated approach of active and multidisciplinary learning and not necessary identical from one institution to another.

3. Five Ladders of Active Learning

At University Tun Hussein Onn Malaysia (UTHM), PBL has been implemented since 2005. Since then, PBL has become a major teaching and learning approach at this institution. Some problems were reportedly faced by the faculty members regarding the selection of the most appropriate approach for them to implement PBL. Some of the trained lecturers were using knowledge and experience gained during training at institutional and national levels. Those who lack of training have to depend on their own interpretation of PBL and as a result they had developed their own versions of PBL which is in fact far from a true spirit and philosophy of PBL. Same thing goes to the students. Having meeting with many versions of PBL they have developed the sense of intimidating and frustrating. This was a common scenario occurred over times in institutions where students were not well informed, equipped and trained on how to take part in PBL learning (Barret, 2010).

Efforts have been made to overcome this problem and among which more training sessions were conducted for new faculty members. The most innovative step taken is the designing and implementation of a proper PBL learning process that truly accommodates the needs of the faculty, students and university as a whole. The PBL learning process invented in 2011 called 5 Ladders of Active Learning and was implemented as a combination with a proper learning module and system called Smart, Active and Interactive Learning (SAIL) system. Both the PBL learning process and the system were copyrighted in 2012.

While designing this innovative PBL learning process, we take into consideration some of the most important PBL cycle and course structure. Three examples of PBL cycle as shown in figure 1, 2 and 3 and discussed by Oon Seng (2003) were taken as one of the designing frameworks.

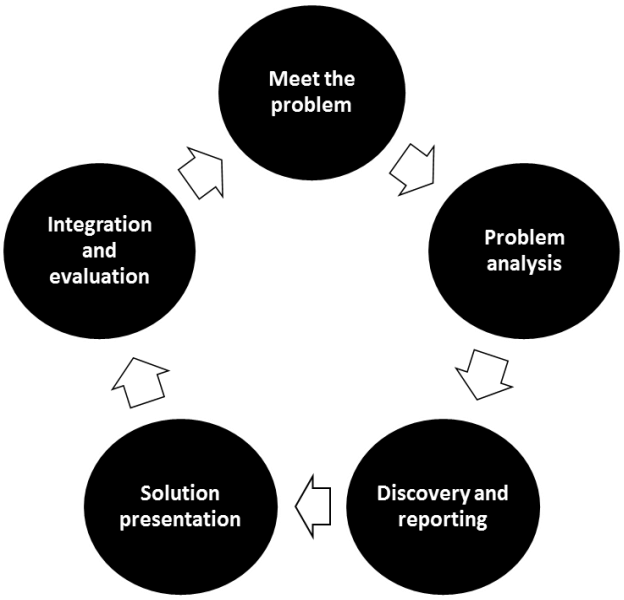

Figure 1. PBL cycle 1

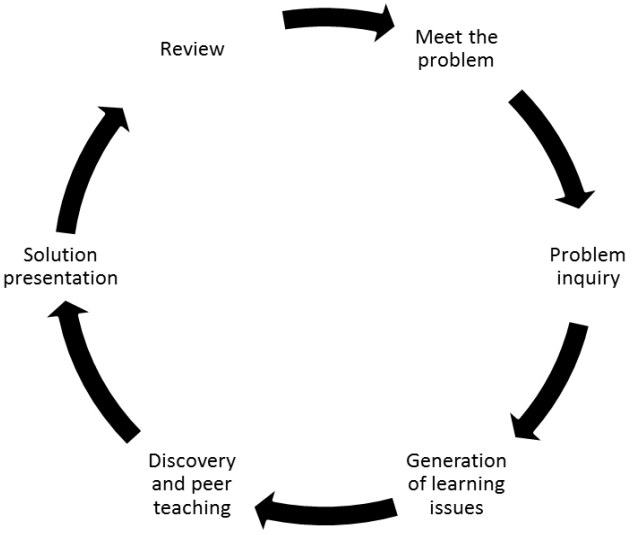

Figure 2. PBL cycle 2

Figure 3. PBL cycle 3

Based on these three cycles, 5 Ladders of Active Learning PBL process was successfully designed. In order to ensure the successful implementation of this innovation, three other factors were also taken into consideration. First, the time frame for the whole 5 ladders to be implemented. Second, the student learning time and space, including inside classroom, outside classroom, individual learning, group learning, assisted learning and self-directed learning. Third, the type, scope, format and number of problem triggers given to the students. Reflection activity was included into each ladder as this activity is one of the most crucial stages in PBL cycle to help learners achieve optimal learning outcomes (Hung, 2006). By reflecting on the knowledge and skills they have constructed throughout 5 Ladders of Active Learning, learners have an opportunity to organize and integrate their knowledge into a more systematic conceptual framework and enhance their conceptual integration and retention of the subjects they have learnt.

In 5 Ladders of Active Learning, PBL learning starts at Ladder 1 in which the topic will be introduced to the students through a presentation of a problem scenario for each unit. The students then, work in the group to identify the learning issues using 3 Active Thinking Points (Identification of the facts, Ideas generation and Identification of learning issues). To conclude the Ladder 1 learning, the students will complete the reflection form and soon climb to the Ladder 2.

At Ladder 2, the students will have to embark on self-directed learning activities including reading the materials, watching the videos, summarizing the topic and to search for additional and supporting learning materials. To conclude the learning activities at Ladder 2, the students will have to complete the reflection form. At Ladder 3, the students will have to conduct the meeting and to report the result of their self-directed learning and prepare for the presentation at Ladder 4. To conclude the learning activities at Ladder 3 they will also have to complete the reflection form. At Ladder 4, the students will have to present their result of learning. The presentation can be in many forms. It could be a parallel presentation or a single presentation or a forum discussion. Again, to conclude the learning activities at Ladder 4, the students will have to complete the reflection form.

Ladder 5 is the final stage of learning for the topic. At this level the students will be provided with a number of proper exercises to improve their learning. The exercises can be in many forms. It could be in form of interactive Multi Choice Questions in which the students will be able to test their understanding and mastery of the topic through interactive approach. Finally, to conclude the learning activities at Ladder 5 and overall learning of the topic, the students will have to complete the reflection form. There will also be an overall reflection on the course at the end of the session. The students will have to complete overall reflection of their learning in the specific course and to answer a questionnaire set. The reflection and questionnaire set could be used by the instructors to identify the effectiveness of the overall learning as well as the module. Table 2 below shows overall learning process involved in 5 Ladder of Active Learning.

Table 2. Learning process in 5 Ladder of Active Learning

Step / Ladder	Ladder 1	Ladder 2	Ladder 3	Ladder 4	Ladder 5
Step 1	Introduction to case scenario / problem	Video input	Group meeting	Presentation	Exercises
Step 2	Identification of facts	Summary of the module	Reporting to the group	Peer assessment	Reflection on exercises
Step 3	Ideas generation	Overall module revision	Group's conclusion	Discussion	Reflection on the result of learning
Step 4	Identification of learning issues	Further self-directed learning	Presentation preparation	Conclusion	Reflection on the process of learning
Step 5	Reflection	Reflection	Reflection	Reflection	Overall reflection

Besides the fundamental challenge of designing a complete and practical PBL learning process, PBL practitioners are faced with the task of deciding how to evaluate the innovative learning process effectively and how to assess whether students have met the overall learning outcomes after going through the learning process. Main characteristics of PBL which is emphasise on the student-centered and self directed learning have created unique challenges for development of an effective assessment technique to be included in 5 Ladders of Active Learning. Two major aspects of PBL process were taken into serious consideration while designing the assessment procedure for this new innovative PBL learning process. One is the content of learning and the other is the process of learning.

Thus, this new innovative PBL learning process was completely designed with a structured assessment procedure covers both the content and the process of learning. Specifically, there are procedures, forms and rubrics designed and incorporated into the implementation of 5 Ladders of Active Learning. At Ladder 1 two set of assessment procedures were developed. One is to assess the quality of problem solving technique called FILA (facts, ideas, learning issues and action plan) and the other is a set of rubric to assess their learning reflection which is representing their mastery of learning process. At Ladder 2 and 3, there is a set of assessment procedure developed to assess students learning reflection at both ladders. This is again represents their mastery of PBL learning process. At Ladder 4, assessment procedure is using peer assessment presentation rubric. The students will be able to assess other groups during the presentation. Finally, at Ladder 5 there are two assessment procedures. First is a self-assessment instruments using multi choice questions and second is overall learning reflection procedure using specific rubrics representing the mastery of knowledge (content) and skills (process). Table 3 below shows a complete assessment procedures conducted in 5 Ladders of Active Learning.

Table 3. Assessment Procedures in 5 Ladder of Active Learning

Ladder	Assessment Procedure
Ladder 1	FILA & Reflection Rubrics
Ladder 2	Reflection Rubrics
Ladder 3	Reflection Rubrics
Ladder 4	Peer Assessment (presentation) & Reflection Rubrics
Ladder 5	Self-assessment (MCQ) & Overall Reflection Rubrics

4. Background of the study

In order to identify the effectiveness of this new invented PBL learning process, a study was conducted among 148 students from 4 faculties taking a compulsory general course at Faculty of Science, Technology and Human Development. The respondents were trained and exposed to use of 5 Ladders of Active Learning in first three weeks of the semester. Beginning in week four to the end of the semester they were actively involved in using this innovative learning process together with a learning package called Smart, Active and Interactive Learning for the specific course. Among the research questions of this study are:

1. Did 5 Ladders of Active Learning be able to create an active learning environment?
2. How appropriate the problem triggers given to the students to let them start PBL learning process using 5 Ladders of Active Learning?
3. How was the perception of the students upon the introduction of 5 Ladders of Active Learning to improve their PBL learning experience?
4. What are the skills gained by the student after participating in PBL learning activities using 5 Ladders of Active Learning?

Thus, based on the above research questions, this study is embarked in order to identify:

1. The potential of 5 Ladders of Active Learning to create an active learning environment for the students in PBL setting.
2. The appropriateness of the problem trigger given for their PBL learning process using 5 Ladders of Active Learning
3. Student perception on the introduction of 5 Ladders of Active Learning to improve their PBL learning experience
4. Skills gained by the student participating in PBL learning activities using 5 Ladders of Active Learning

This study is a descriptive study research utilizing both quantitative and qualitative data. The quantitative data was collected at the end of semester using a set of questionnaire comprises of 25 items. While for the qualitative data, the students were asked to reflect on their learning experience at the end of the semester. The qualitative data is collected in order to support the overall findings of the study. Since this research is a case study research and focusing on the experience of a group of students involved in using PBL as their learning tool, the exclusion of any respondent would certainly jeopardize the finding. Thus, all 148 engineering, technology and technical education students enrolled in a compulsory university subject from two specific classes of 2011/2012 session were selected to be the respondents of this study. The quantitative data collected was analyzed using

Statistical Packages for Social Sciences (SPSS version 13.0). The data was reported in form of percentage and mean score. The five Likert scale was summarized into three scales of "Agree" (comprises of "Extremely Agree" [5] and "Agree" [4] scales, "Uncertain" [3] and "Disagree" (comprises of "Extremely Disagree" [1] and "Disagree" [2] scales). Mean score is based on the scores between 1 (the lowest) and 5 (the highest).

5. Data Analysis and Findings

The data shows that 52.7% of the respondents (N=78) are male and 47.3% (N=70) are female. The age of the respondents is between 19 to 24 years old in which the data shows that most of them 45.9% (N=68) are 19 years old, 11.5% (N=17) are 22 years old, 6.1% (N=9) are 21 years old, 21.6% (N=32) are 22 years old, 8.1% (N=12) are 23 years old and only 3.4% (N=5) are 24 years old. Most of the respondents are from first year students which comprise of 85.8% (N=127), 7.4% (N=11) from second year, only 2% (N=3) from third year and 1.4% (N=2) from final year students.

The first objective of this study is to identify whether the application of 5 Ladders of Active Learning has led the students to learn actively? The data shows that 89.9% of respondents (N=133) agree to this statement. Ultimately this shows that this innovative PBL learning process has successfully designed for an active PBL learning environment. Table 4 below shows the percentage of respondents responded to the first question.

Table 4. Data on the first research objective

Item	Statement	% Agree (N=)	% Uncertain (N=)	% Disagree (N=)
1	I learn actively using 5 Ladders of Active Learning	89.9% (133)	8.8% (13)	1.4% (2)

Four questions related to the appropriateness of the problem triggers given for the students to start their PBL learning process were posted. First question asked whether the problems given are closely related to the learning topics. The data shows that 84.5% of respondents (N=125) agree that the problems given were closely related to the learning topics. Most of the respondents were also agree that the problems given are related to outside experiences. The percentage of respondents agreed on this statement is 85.8% (N=127). Next question related to the appropriateness of the problem given is asking the respondents whether the problems given need a serious and deeper research. The data shows that 85.2% of the respondents (N=126) agree that the problem given for them to embark in PBL learning process using 5 Ladders of Active Learning really need a serious and deeper research. Most of the respondents were also agree that the problems given are very demanding and require them to apply a higher level of thinking skills. Table 5 below shows the data related to the second objective of this study.

Table 5. Data on the second research objective

Item	Statement	% Agree (N=)	% Uncertain (N=)	% Disagree (N=)
2	Problems given related closely with the topics	84.5% (125)	12.8% (19)	2.7% (4)
3	Problems given related to outside experiences	85.8% (127)	14.2% (21)	0% (0)
4	Problems given need serious and deeper research	85.2% (126)	14.2% (21)	0.7% (1)
5	Problems given need higher thinking levels	80.4% (119)	13.5% (20)	6.1% (9)

Third objective of this study is to identify the students' perception on 5 Ladders of Active Learning after they have gone through the PBL experience using this innovative learning process. 6 questions related to this objective were posted and the data is shown in table 6 below. Based on the data, the majority of respondent view that 5 Ladders of Active Learning is positively have impact on their learning. 72.3% (N=107 and mean score) agree that this learning innovation has attracted their learning interest. Mean score recorded for this item is comparatively high (3.8041). 68.9% (N=102, mean score 3.7365) of the respondents agree that this innovative learning process is easy to follow. Most of the respondents (77%, N=114, mean score 3.9392) were also agree that this learning innovation is very effective for improving their active learning process. While 71.6% (N=116, mean score 3.8514) of the respondents agree that 5 Ladders of Active Learning is highly structured and better facilitates their group learning. Most of the respondents (81%, N=120, mean score 4.1284) were also agree that this PBL learning process is a new innovation with regards to their learning experience. Finally, most of the respondents (79.8%, N=118, mean score 4.0068) were also agree that this learning innovation is highly effective in guiding their learning process. Table 6 below listed the details of data related to the third objective of this study.

Table 6. Data on the third research objective

Item	**Statement:** 5 Ladders of Active Learning …	% Agree (N=)	% Uncertain (N=)	% Disagree (N=)	Mean Score
6	…attracts my learning interest	72.3% (107)	23.6% (35)	4% (6)	3.8041
7	…is easy to follow	68.9% (102)	23% (34)	8.1% (12)	3.7365
8	…is effective for improving my active learning	77% (114)	18.9% (28)	4.1% (6)	3.9392
9	…is highly structured and facilitates a better group learning	71.6% (106)	21.6% (32)	6.8% (10)	3.8514
10	…is a new innovation for my learning	81% (120)	14.9% (22)	4% (6)	4.1284
11	…is highly effective for guiding my learning process	79.8% (118)	14.9% (22)	5.4% (8)	4.0068

Final objective of this study is to identify skills gained by the students after they have participated in in PBL learning process using 5 Ladders of Active Learning. 14 items related to the essential learning skills and humanistic skills were listed and the students asked to give their response through 5 Likert scale. The result of this survey shows that all skills recorded higher mean scores (above 4.0). Thus, it is evidently proved that this new learning innovation had a high impact on the development of students' essential learning skills and humanistic skills.

Table 7. Mean score of students' essential learning skills and humanistic skills

Item	Skills Improved	Mean Score	SD
12	Self directed learning	4.1554	.72574
13	Group learning skills	4.2635	.66355
14	Understanding of the subjects	4.0676	.79678
15	The mastery of noble values	4.0811	.72387
16	Communication skills	4.2365	.72244
17	Team working skills	4.3446	.68723
18	Self respect and the respect of others	4.2703	.66593
19	Problem-solving skills	4.2432	.67634
20	Thinking skills	4.1757	.70678
21	Management skills	4.2162	.68552
22	Decision making skills	4.1892	.64261
23	Information management skills	4.1216	.68913
24	Life long learning skills	4.2027	.65941
25	Skills to act wisely	4.2297	.67102

6. Discussion

Finding shows that students highly appreciate the introduction of 5 Ladders of Active Learning and it was seen as highly effective in improving their PBL learning experience. However they were also suggested that 5 Ladders of Active Learning be incorporated into a comprehensive learning system including with the incorporation of interactive learning materials and paperless learning initiative. Thus, further studies focussing particularly on the development of a comprehensive learning system with the incorporation of interactive learning materials and paperless learning initiative is highly recommended in the near future.

This study has proven that a proper planning and designing of PBL learning process will ultimately bring about the successful implementation of PBL in any higher learning institution. Although most of the respondents were considered as "first timer" and lack of experience in PBL, they managed to follow the PBL learning process and be able to enjoy the outcomes of the learning. This is certainly due to a proper installation of PBL learning process through 5 Ladders of Active Learning.

The initiative behind the innovation of 5 Ladders of Active Learning is driven by the needs of the students. It was because of the difficulties faced by the students in the past to embark on PBL learning process that triggered the innovation of this PBL learning process. By taking into consideration the needs of the students and their views, this innovation is indeed following the spirit of PBL curriculum design whereby students were gradually included in the process of designing a better PBL curriculum (Hung et.al, 2007). PBL as a philosophy is itself a very powerful ideas that bring about a great change in learning and teaching perspectives among students and faculty members at higher learning institutions (Kolmos, Du, Holgaard & Jensen, 2008). The ability to develop a comprehensive model and a practical learning process would certainly be more helpful for many increasing number of PBL practitioners to implement this approach successfully at their institution. Students will also be able to follow easily the learning steps and enjoy the benefits of learning process and product along the way.

7. Concluding comments

For decades, teaching and learning process at tertiary level had been discovered to be stagnant with the over utilization of traditional lecturing approach. Knowledge, skills and values are failed to be delivered satisfactorily to the students due to the single way approach of teaching and learning which centered mostly around lecturers. Many of the public universities graduates were claimed to be passive and unable to perform their job (Singh & Singh, 2008). Failures during interview sessions surprisingly increased due to the inability of the graduates to communicate effectively and to convince the employers of their humanistic and social skills (New Strait Times, September 2 & July 22, 2009). Government as well as educationists all over the country had sensed this situation and the issues have been taken into serious consideration. The Malaysian Ministry of Higher Education (2007) for instance had requested all public universities to tackle this problem immediately through the introduction of generic skills or soft skills programs. Since then the efforts had been put into implementation accordingly. One critical way to improve the generic skills of the students is to opt for a proper approach in teaching and learning called the experiential learning in which learning centered around the students rather than lecturers. Excellent teaching and learning approach such as PBL is becoming one of the most critical success factors that a university should give more attention and focus. PBL is increasingly accepted as an active and innovative learning approach towards the development of more innovative education systems. It can be a predominant mode of learning particularly with a good planning, management support, resource allocation and staff development (Oon Seng, 2003).

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