Perspectives

What Do We Know About the Language Learning Motivation of University Students in Japan? Some Patterns in Survey Studies

Kay Irie
Temple University Japan

This review identifies patterns of motivation exhibited by Japanese university students by examining a representative selection of survey studies that have mainly employed factor analysis and which have been conducted since 1990. This collection of surveys includes works published in Japanese. Two sets of contrasting motivational concepts highlight the recurring patterns: (a) instrumental and integrative motivation and (b) mastery and performance goal orientation. The research suggests that Japanese university students appreciate a utilitarian value of learning English, and have an interest in communicating with native speakers of the target language. While performance orientation may be important, mastery orientation has been shown to relate more strongly to the use of strategies. The review also demonstrates the relevance and limitations of these constructs.

本論では1990年以降に発表された日本人大学生の言語学習モチベーション(L2 motivation)に関するアンケート調査（日本語で発表されたものを含む）の報告にみられる傾向を検証する。理解を助ける為、二組の概念が用いられる。一つはすでによく知られているガードナーの道具的及び統合的動機、もう一つは比較的新しいマスタリーとパフォーマンス志向である。先行研究によると日本人学生は英語学習の道具的な価値を認め、旅行やNSとの交流に興味を持っていることがわかる。パフォーマンス志向の存在が認められるもののマスタリー志向の方がより強く学習ストラテジーの使用と関連性があると報告されている。本稿ではこれらのモチベーション概念が日本人大学生の動機づけを理解する上での妥当性及び限界考察する。尚、現在の言語学習モチベーションにおける因子分析の役割についても言及する。
Motivation has long been regarded as crucially important in second/foreign language (L2) learning, and has therefore attracted considerable research interest. The seminal line of research by Gardner and associates in Canada in the 1970s has been expanded to the rest of the world by others as evidenced most recently by the contributions in Dörnyei and Schmidt (2001) and has continued to develop in Japan (e.g. Benson, 1991; Berwick & Ross, 1989; Horino & Ichikawa, 1997; Johnson, 1996; Kimura, Nakata, & Okumura, 2001; Kubo, 1999; McClelland, 2000; McGuire, 2000; Miyahara, Namoto, Yamanaka, Murakami, Kinoshita, & Yamamoto, 1997; Nakata, 1999; Yamamoto, 1993; Yamashiro & McLaughlin, 2000; and Yashima, 2000). The research in Japan, largely at the post-secondary level, has for the most part focused on identifying the underlying structures of L2 motivation in Japanese EFL contexts. Methodologically, the Japanese research has generally followed the earlier studies in employing factor analysis. The purpose of this paper is to make available to a wider audience the developments since 1990 in L2 motivation research in Japan, including works written in Japanese, in the hope of clarifying what we know to date about the L2 motivation of EFL university students in Japan, as well as indicating directions for future research.

First, I will introduce the two sets of contrasting motivational concepts chosen to highlight the recurring patterns in the selected L2 motivation studies, one familiar and the other relatively new in the field of L2 motivation research: (a) instrumental and integrative motivation and (b) mastery and performance goal orientation. An explanation will be given as to why I have chosen these particular distinctions despite the former having been criticized by various scholars (e.g. Au, 1988; Dörnyei, 1990; Oxford & Shearin, 1994) and despite the latter resembling the well-known pairing of intrinsic and extrinsic motivation. This will be followed by a brief explanation of factor analysis, the research tool used in most studies reviewed, and a discussion of specific findings on the L2 motivation of Japanese university students related to the selected concepts.

**Two Sets of Motivational Concepts: Familiar and New**

*Instrumental and Integrative Motivation*

The first set of concepts that thread together some of the current findings of L2 motivation studies in Japan is instrumental and integrative motivation. Nearly all survey studies have included items intended to
measure these two best known concepts of Gardner’s work. Both refer
to types of desires related to learning an L2. Integrative motivation
originally referred to a desire to assimilate into the target language (TL)
community (Gardner & Lambert, 1972). Recently it has been interpreted
more broadly as a general positive disposition towards TL cultures and
speakers (Gardner, 2001). Instrumental motivation refers to a desire
to gain such benefits as getting a better job or passing an entrance exam.

Based on the results of vast empirical research in Canada using
his socio-educational model, Gardner (1985, 2001) emphasizes the
importance of integrativeness, as he considers being indispensable
for the development of near-native level proficiency. Although the
concept of integrative motivation has intuitive appeal and is backed by
empirical research, the model has been criticized for the inconsistent
use of the terms “motivation” and “orientation” and the limitation of the
integrative-instrumental dichotomous view (e.g., Crookes & Schmidt,
1991; Dörnyei, 1994a, 1994b). Since most of Gardner’s research has been
in second language (SL) contexts, Dörnyei (1990) held the position that
Gardner’s concepts of integrative and instrumental motivation lacked
relevance to foreign language (FL) learning contexts. FL learners are
usually not exposed much to TL cultures or speakers and often their
aim is to make friends or do business with other nonnative speakers.
Thus, in Dörnyei’s view, integrative motivation in FL learning contexts is
determined by “a general disposition toward language learning and the
values the target language conveys” (p. 65) rather than attitudes toward
the TL community. Based on a study in a monolingual EFL context in
Hungary, Dörnyei (1990, 1994a) also pointed out the overlap between
integrative and instrumental motivation in FL learning contexts because
emigration to and studying in a TL community is often associated with
career-related goals.

Despite the controversy surrounding these terms, instrumental and
integrative motivation have still been the largest common denominators
of the Japanese survey studies from the 1990s to the present. A review
of the research on these concepts will help us to understand some
characteristics of the L2 motivation of Japanese university students. At
the same time, the review will show some limitations of the concepts as
mutually exclusive categories into which Japanese learners’ motivation
can be divided.
Mastery and Performance Goal Orientation

Mastery and performance orientation, the second set of concepts, are rather new in the field of L2 motivation research although they are the two major concepts in goal orientation theories in motivational psychology. These concepts were originally developed by developmental and educational psychologists to explain children’s behavior in school. Considering that English is taught as a school subject in Japan, it may be advisable to consider the Pintrich and Schunk (1996) suggestion that goal orientation theories represent “the most relevant and applicable goal theory for understanding and improving learning and instruction” (p. 233). These two concepts overlap to some extent with the two well-known concepts, intrinsic and extrinsic motivation. Mastery goal orientation can be considered a contemporary view of intrinsic motivation with a focus on personal cognitive goals in educational learning situations (Pintrich & Schunk, 1996). The concept of intrinsic-extrinsic motivation focuses on reasons for doing the task. Intrinsically motivated people engage in tasks for the joy of doing them or to satisfy their curiosity (Dörnyei, 2001b). Extrinsically motivated people engage in tasks to receive an external reward (Dörnyei, 2001b). On the other hand, mastery-oriented learners focus on the value of learning itself, for personal growth, more than on whether or not they enjoy learning. Thus they tend to choose challenging tasks and view errors as opportunities for learning (Dweck, 2000). Also, central is the belief that effort will lead to success (Dörnyei, 2001b). Performance-oriented learners engage in tasks to demonstrate to others their worth or competence. Their goal is set on a performance level: to get high grades, to win recognition of their significant others, or to do better than other students. Thus, they tend to avoid problems that are too hard but prefer tasks that are just hard enough to convey an impression of competence (Dweck, 2000).

Mastery and performance goal orientations have been empirically investigated in connection to a wide range of cognitive, affective, and behavioral outcomes in educational psychology and the research provides rich implications for ways to consciously raise students’ motivation in the classroom (e.g. Dörnyei, 2001b; Pintrich & Schunk, 1996; for specific motivational strategies, see Dörnyei, 2001a). In this light, although no specific studies have as yet addressed mastery and performance goal orientation in Japanese L2 motivation studies, these orientations should be of value toward interpreting findings in previous studies.
What Can Factor Analysis Tell Us?

One way of understanding a multifaceted construct such as motivation is to identify a set of relevant underlying components. Most of the studies reviewed in this paper attempted to accomplish this by employing a statistical procedure called factor analysis. According to Kachigan (1991), factor analysis is a technique used to simplify a set of data by “clustering a large number of variables into a smaller number of homogeneous sets and creating a new variable “a factor representing each of these sets.” By simplifying the data in this way, “we are more likely to gain insight into our subject matter” (p. 238).

In L2 motivation research employing questionnaires, this usually means analyzing responses to items such as “I want to make foreign friends,” “I enjoy speaking with native speakers,” or “I like to correspond with foreign pen pals” in order to find underlying commonalities. A factor analysis can demonstrate that respondents who strongly agree with the first item will by and large agree with the other two as well. It is thus both sensible and empirically justifiable to group these items together and give them a collective label, such as Integrative Orientation. The end product of a factor analysis is a factor matrix which shows the correlations, called factor loadings, between the newly derived factors and the questionnaire items which comprise them. Factor loadings can range from -1.00 to +1.00, and indicate the strength of the relationship, negative or positive, between an item and its factor. (For more details on the role of factor analysis in L2 motivation research, see Dörnyei, 2001b; for factor analysis in general, Kachigan, 1991.)

It is difficult to simply compare the factor structures of different studies, as the results depend on the items entered into each analysis and the labeling of factors is ultimately subjective. Nevertheless, we can highlight some patterns when we compare those studies using questionnaires with similar items administered to learners in similar contexts (Dörnyei, 2001b; Schmidt, Boraie, & Kassabgy, 1996). Thus, the recurring factors pointed out in this review are selected not only for the labels applied to them by the original researchers, but also for the similarities of the items.

Instrumental and Integrative Motivation of Japanese Learners

It will be apparent in the subsequent discussion that integrative motivation among Japanese EFL university students is not identified in research as clearly as instrumental motivation. Most studies on Japanese
university students report a factor indicating positive disposition towards native speakers and the cultures of the TL community. One can interpret this as a form of integrative motivation, and indeed researchers refer to the concept by acknowledging the similarity to Gardner's expanded definition: positive attitudes towards TL communities and TL speakers, without a desire to assimilate into them (Gardner, 1985, 2001). However, the researchers avoid using integrative motivation as a label, as they believe the factor does not fit the original definition. Another possible reason for avoiding the label is that in many studies the positive disposition factor included items on utilitarian interests, such as travelling, which blurred the distinction between integrative and instrumental motivation as pointed out by Dörnyei (1990, 1994a).

**Presence of Instrumental Motivation**

Not surprisingly, Japanese university students seem to value the importance of English as a means to an end. A factor comprised of instrumental reasons has emerged in most studies of the L2 motivation of Japanese university students (e.g., Johnson, 1996; McGuire, 2000; Miyahara et al., 1997; Yashima, 2000). In their large cross-sectional study including a wide range of Japanese learners of English from junior high school to university students and language school adult learners, Kimura, et al., (2001) found that the instrumental motivation of Japanese learners of English ($N = 1,027$) is mostly related either to career or examinations. Its relation to the students’ effort and proficiency will be discussed later in comparison with that of integrative motivation in Japanese EFL contexts.

**Desire for Cross-Cultural Communication: Is it Instrumental or Integrative?**

One of the most noticeable recurring patterns found in Japanese EFL university contexts is a positive orientation to foreign travel without any apparent desire to integrate into the TL culture (e.g. Benson, 1991; Berwick & Ross, 1989; Johnson, 1996; McClelland, 2000; McGuire, 2000). Fotos (1994) considers that “the desire for travel and encounter with global culture represents the new instrumental [italics added] motivation, indicating a personal orientation towards international experience for self-actualization in global society” (p. 50). However, recent studies seem to indicate that this travel orientation may have more in common with integrative motivation than instrumental motivation.
In their large multi-level study mentioned above, Kimura et al. (2001) labeled their first factor Intrinsic-Instrumental-Integrative Motive and their second factor Extrinsic-Instrumental Motive. The items dealing with traveling and studying overseas originally posited as instrumental, loaded on Factor 1. This indicates that these items regarding traveling and studying overseas have more in common with integrative and intrinsic items than the other instrumental or extrinsic items which clustered on Factor 2.

The desire for overseas experience may be common to university students in other EFL contexts in Asia. Miyahara et al. (1997) carried out a large-scale study, which compared not only motivation but also various other aspects of English learning of university students in China, Korea, and Japan ($N=1,781$). In the data from all three countries, the researchers found a factor representing a general interest in travelling and making friends with people of TL communities and they labeled it Personal Communication. It is intriguing that the researchers also found the original type of integrative motivation (labeled Integrative Motivation), a desire to become integrated into the TL communities in the Chinese and Korean samples, in addition to the Personal Communication factor. On the other hand, their Integrative Motivation factor did not emerge in the Japanese sample. Integrative Motivation in the Chinese and Korean data was composed of such items as “I want to marry someone from an English speaking country,” “I am attracted to cultures of English speaking countries,” and “I want to work professionally in English speaking countries.” Thus, the Chinese and Korean students seem to exhibit two different levels of positive attitudes toward cultures and people of English speaking countries. The researchers conclude that the integrative motivation of Japanese university students is defined by a general positive interest in traveling and communicating with people from English speaking countries. Unlike their Chinese and Korean counterparts however, there was no strong desire to learn English in order to integrate into TL communities, as in the original sense of integrative motivation.

**Instrumental and Integrative Motivation in Relation to Proficiency**

When it comes to learning behaviors and proficiency, no clear patterns of correlation are found with either instrumental or integrative motivation. In her study of 389 first-year Information Science majors, Yashima (2000) reports a moderate correlation between a factor called Instrumental Orientation and TOEFL ($r = .31$). However, in Johnson
Perspectives (1996), a factor labeled Work correlated only marginally with proficiency scores on midterm examinations ($r = .19$) in a sample of 204 first-year students of various majors in communication skills classes. Still, the importance of instrumental motivation in FL learning contexts pointed out by Dörnyei (1990) and Okada, Oxford, and Abo (1996) is demonstrated by its high correlations with strength of motivation measures ($r = .72$ in Yashima, $r = .60$ in Johnson).

Integrative motivation is also an important measure which may explain the Japanese students’ lowest and the Chinese students’ highest average of proficiency among the three Asian countries compared in Miyahara et al. (1997). Dörnyei (1990) suggests that instrumental motivation plays a significant role in the attainment of an intermediate level of proficiency in FL learning contexts, but for the levels beyond, positive attitudes towards the TL cultures are necessary. The strongest factor in the Japanese university students’ data was labeled as Instrumental Motivation, although we have no way of knowing the level of proficiency. In addition, Miyahara et al. claim that those Japanese students who scored above and below the mean of the proficiency measures (TOEFL-based listening, structure, vocabulary, reading tests) significantly differ in the factor score of Instrumental Motivation. The factor correlates only minimally with listening comprehension ($r = .10$) and does not correlate with any of the proficiency measures of other skill areas.

On the other hand, Yashima (2000) reports that learners who are both instrumentally and integratively motivated are likely to show better learning behaviors. The factors labeled Instrumental and Intercultural Friendship were found to be fairly good predictors of motivation (effort and desire to learn) through multiple regression, a statistical procedure used to identify unique contributions of each factor to the variable of interest and a combination of factors that can best account for the variance. The analysis indicated that 62% of the variance could be explained by the combination of both instrumental and integrative factors. Using path analysis, a technique related to multiple regression analysis that allows us to chronologically model influences of preceding events on the variable of interest, Yashima concludes that these instrumental and integrative reasons for learning can affect proficiency only through the mediation of effort and desire to learn. This pattern is also reported in Yamashiro and McLaughlin’s (2000) study of a total of 220 junior college students majoring in English and four-year university students majoring in law and politics. In their study they used another advanced statistical procedure, structural equation modeling (SEM) in which cause-effect
relationships can be tested on correlational data (Dörnyei, 2001b). Both studies offer partial support for Gardner’s socio-educational model and its applicability in Japanese EFL contexts. That is, learners’ attitudes toward and reasons for learning English affect learning behavior, which in turn contribute to proficiency in Japanese university contexts.

Mastery and Performance Goal Orientations of Japanese Learners

Since no previous study in Japanese EFL contexts has yet investigated mastery and performance goal orientation in L2 motivation, these labels have not been applied by researchers either to scales or to factors. However, a close examination of items forming some factors reported and studies involving related goal-orientation concepts suggest the relevance of a mastery and performance goal orientation.

Mastery Goal Orientation—Development of Proficiency as a Goal

One of the factors that Miyahara and his colleagues (1997) found across the data from Japanese and Korean universities pertained to the desire for further development of proficiency in English. The factor was labeled Desired Development of Total Language Proficiency (DDTLP). They suggest that the desire to develop proficiency itself can be a goal for learning English in EFL contexts. Many of the items included in this factor reflect a desire to improve fluency or competence in English. In other words, the reason for learning English is precisely to become better in English. This comes close to the concept of mastery orientation as summarized in Pintrich and Schunk (1996): success is defined by improvement, progress, mastery, and learning itself. Adopting the questionnaire used in Miyahara et al. (1997), Yamamoto (1993) also found a factor with a similar composition of items in the data of 268 second-year university students.

In the field of motivational psychology, mastery orientation is usually associated with intrinsic interest in learning, choice of challenging tasks, and higher levels of achievement. It is generally considered to facilitate learning as it is considered to be adaptive: students attribute their success to their own effort, which they believe they have control of and they therefore keep on trying. In the Japanese EFL context, the adaptive pattern of mastery orientation has not been fully demonstrated for achievement in English as a school subject for overall proficiency. While Miyahara et al. (1997) found almost no correlation between the factor DDTLP and various proficiency measures of the Japanese and Korean
students, Yamamoto (1993) reports a significant correlation of DDTLP with the results of reading and listening tests ($r = .37$).

**Performance Goal Orientation—The Importance of Doing Well**

Performance goal orientation, a counterpart of mastery goal orientation, may also be able to explain a part of Japanese students’ motivation. Performance orientation is usually associated with a desire for high grades (status) and better performance than others.

In McGuire’s (2000) study, a factor he called External Influence is composed of six items which represent characteristics of performance goals: “It is important for me to do better than the others in class”; “I want to do well in this class because it is important to show my ability to my significant others”; “The main reason I need to learn English is to pass examinations”; “The main reason I am taking this class is that my significant others want me to improve my English”; “Being able to speak English will add to my social status”; and “I expect to do well because I am good at learning English.” These items originally belonged to the subscales of Intrinsic Motivation, Personal Goals, and Expectancy/Control Components. The inclusion of a classic instrumental motivation item on passing exams indicates some overlap between instrumental motivation and performance orientation. Since McGuire found the External Influence factor in both the Osaka and Nagoya group data analyzed separately, it may be that a performance orientation is a widespread aspect of the L2 motivation of Japanese university students. If this is found to be true, the concept may shed some light on many Japanese university students’ underachievement and apathy in learning English, because a performance orientation is usually associated with maladaptive, helpless patterns of attribution. When performance-oriented students experience failure, they tend to attribute their failure to lack of ability, which they believe cannot be changed. Therefore, they are inclined to do the minimum necessary to avoid losing face, feeling that nothing they can do will lead to mastery (Pintrich & Schunk, 1996).

**Goal Orientations and Better Use of Learning Strategies**

An association between mastery-goal orientation and better use of learning strategies was suggested in Kubo’s (1999) study of 330 first- and second-year non-English majors at national universities. The study was based on an open-ended survey in which Japanese university students were asked to reflect on their reasons for studying in high school. In her
study, she regarded the use of learning strategies as representing motivational behavior. Utilizing SEM, Kubo tested her orientation-appraisal model to explain causal relationships among fulfillment-training (FT) and pride-reward (PR) orientations, cognitive appraisal (self-evaluation of learning skills and cost of learning), learning behavior (study time and use of strategies), and performance (a vocabulary and cloze test) of EFL university students. The model hypothesizes that students’ reasons for learning and cognitive self-appraisal would influence learning behavior which would further affect performance. Under the FT orientation, learners attach value to the content of their learning, whereas under PR orientation they value rewards and self-esteem. These closely parallel the concepts of mastery orientation and performance orientation (for details on FT and PR orientation featured in the two-factor model of learning motivation, see Ichikawa, 1995).

Kubo (1999) found that an FT orientation generally associates with other motivational variables. In the structural equation models presented, only FT orientation covaried with cognitive appraisals and contributed to learning behavior for both liberal arts and science majors. When correlations among all variables were examined, FT orientation significantly correlated with all the other variables. On the other hand, PR orientation correlated only with use of general learning strategies ($r = .21$ to $.30$) and less than FT orientation did ($r = .50$ to $.51$). This pattern was in agreement with a finding of Horino and Ichikawa (1997) concerning high school students’ motivation for learning English. In their study, 20 to 32% of the variance in the use of strategies was accounted for by FT-oriented reasons for learning but not by any of the PR-oriented reasons. In other words, mastery-oriented learners seem more likely to employ learning strategies than performance-oriented learners.

Assuming the use of learning strategies is positively related to motivation (i.e. Okada, Oxford, & Abo, 1996; Schmidt, Boraie, & Kassabgy, 1996), this finding is in line with the view that mastery orientation is superior to performance goals as the former is associated with adaptive learner characteristics. As many educational psychologists such as Dweck (2000) and Pintrich and Schunk (1996) suggest, teachers should focus on a mastery orientation and foster the belief that ability is changeable and controllable. This is to encourage students to value their own efforts. Therefore, it is important for teachers to recognize students’ efforts. At the same time, the value of learning the content must be emphasized. In FL learning settings, Dörnyei (2001a, 2001b) suggests showing the relevance of materials and lessons to actual language use.
Discussion and Future Directions

To summarize, current research suggests that Japanese university students are likely to appreciate the instrumental value in learning English for exams and a career, and also to have an interest in making contacts with native speakers of English and visiting their countries. This interest appears to be different from the traditional type of integrative motivation, the desire to integrate into a TL community, and may be common to university students in other Asian EFL contexts. Both instrumental motivation and a positive disposition towards TL speakers and cultures influence proficiency positively through effort and a desire to learn. The L2 motivation of Japanese university students may be partially explained also by the concept of mastery orientation in which a goal for learning English is to become more proficient, as well as the often counterbalancing performance orientation whose goals include meeting the expectations of significant others and feeling superior to others. A mastery goal orientation may actually have a positive association with the use of learning strategies, regarded as positive cognitive outcomes of the adaptive pattern reinforced by the orientation (Pintrich & Schunk, 1996).

We have looked at what has been reported in a representative selection of motivation studies, and identified similar patterns in a number of studies using two sets of concepts. In order for these recurring patterns to be fully recognized as constructs describing aspects of Japanese university students’ motivation, in the future the use of factor analysis should be shifted to confirming the patterns suggested in earlier studies. At the same time, it should be remembered that factor structures can describe only the items submitted to the analysis. Since many of these studies were based on Gardner’s Attitudes and Motivation Test Battery (AMTB), it is not surprising that the emerging factors are strongly related to instrumental and integrative motivation. Similarly, studies derived from intrinsic and extrinsic motivation, and goal-related theories have the necessary items for generating mastery and goal orientation factors. If one of our goals is to capture the characteristics of the L2 motivation of Japanese EFL learners in university or in general, we need to keep looking for the most appropriate constructs that function as common denominators across studies and between different learning contexts.

The present review also demonstrates a need to tighten definitions of the constructs under investigation. This concerns not merely pinning
down the core components but also how each construct overlaps with others and how they interact with each other. For example, the travel orientation has demonstrated the limited value of the dichotomous view of integrative and instrumental motivation. This overlapping orientation was found to be clearly differentiated from the original concept of integrative motivation in Chinese and Korean contexts. The overlap between instrumental motivation and performance orientation was also pointed out. In addition, the current research has not yet found a way to investigate how different types of motivation including goal orientations coexist and interplay within each learner.

The lack of other types of research besides questionnaire-based studies calls for a diversification of data collection and analysis. Despite the concern previously expressed by various researchers (e.g. Fotos, 1994; Kimura et al., 2001; Nakata, 1999), qualitative studies employing observations and interviews are still scarce in Japanese L2 motivation research. In addition, the majority of the previous studies are cross-sectional. Longitudinal studies should provide us with opportunities to investigate L2 motivation as a dynamic process.

L2 motivation is both a well-established and rapidly growing area of research in Japan. However, we can see that much more time and continuous effort will be required for understanding this complex multifaceted phenomenon. I believe that this can be facilitated by researchers from different academic circles exchanging ideas among themselves. I hope the present paper has provided an opportunity to draw attention to what has been reported previously in Japanese contexts and has stimulated further interest in the field.

Acknowledgement

My sincere thanks go to Dr. Mark Sawyer of Kwansei Gakuin University for his generous and valuable guidance. I would also like to thank Steve McGuire, Jim Sick, Michael Snyder, and the two anonymous reviewers of JALT Journal for their constructive feedback.

Kay Irie is an Ed.D. candidate in the TESOL program at Temple University Japan. Her research interests include individual differences, particularly the role of attitudes and motivation. She is currently teaching part time at Showa Women’s Junior College. <kayirie@mac.com>.

References


(Received April 15th, 2002; accepted December 29th, 2002)