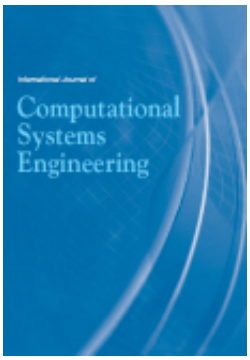

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Particle swarm optimisation-based self-efficacy model for student learning and decision-making capabilities

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Particle swarm optimisation-based self-efficacy model for student learning and decision-making capabilities

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Abstract: Improving the model's structural validity and reliability requires taking into account the students' implicit relationship with the decision-making process about their professions. With a self-efficacy model based on social cognitive theory, this article aims to help students interested in education make more informed career selections. This study aims to evaluate the social cognitive theory-based self-efficacy model in order to find its distinctive elements. If you want to help your pupils find a job that fits their hidden talents, you may utilise their implicit feature matrix. When trainees make professional decisions, a supplemental matrix is used to investigate the hidden relationships among them. Compared to its alternatives – which relied on cluster analysis and the user portrait method – this model exhibited superior structural validity and dependability. The successful model validation provided evidence of this. Therefore, it is a reliable measure of students' confidence in their ability to make good career decisions down the road.

Keywords: social cognitive theory; students; self-efficacy; decision making; particle swarm optimisation; PSO.

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1 Introduction

A person's judgment regarding the job they should choose in a certain job selection situation is what is meant by the term 'career decision-making'. Individuals' professional progress will be directly impacted by the decisions they make regarding their careers. The decisions that individuals make regarding their careers are influenced by a variety of factors, including their own capabilities, learning styles, the social or family context, the potential for career advancement, and so on (Meng and Zhai, 2021). There is a lack of clarity among college students regarding their professional goals, and their comprehension of contemporary career planning is quite limited. As a result, they are unable to devise a comprehensive and workable plan of action. Despite the fact that the students are just marginally employed, they are unable to carry out career growth in a seamless manner, which ultimately results in the failure of employment. One of the most significant turning points in a student's life is when they decide on a career path. Making a decision about a career and working to enhance it has a significant impact on their lives. The social cognition hypothesis is discovered to be a hypothetical approach to the decision-making process regarding a career. The manner in which individuals who make decisions about their careers behave and their cognitive processes are connected. One of the most important factors that plays a role in the decision-making process for an individual's career is their interest in the field (Qiao and Shi, 2020; Kim et al., 2019). This will likely result in an increase in the percentage of students who are successful in finding employment. China's air transport industry is expected to maintain a typical annual development pace of approximately 10% as a result of the rapid progress of China's economy. The continued development of China's sensible flying pattern and the entire industry continues to bring up new developments in the course of events. It is of the utmost importance to cultivate high-quality talents who have a strong knowledge of service and skills in air crew duty. Following that, the focus of this paper is on the self-efficacy model of students for the purpose of professional decision-making in accordance with the social cognitive theory. This study analyses the relationship between self-efficacy and the process of making decisions regarding one's job.

Particle swarm optimisation (PSO) prioritises the utilisation of social contact and the observation of the achievements of peers as a means of providing external reinforcement. The process of comparing oneself to others inside the swarm and gaining knowledge from them is what gives rise to individual self-efficacy. The PSO algorithm makes use of the collective intelligence and experience of the swarm in order to direct individual personal development. Individual particles gain knowledge from the particles that perform the best, progressively modifying their motions and methods in order to arrive at the greatest possible solution. Conventional models devote the majority of their attention to the concept of internal reinforcement, which is achieved via individual methods such as goal planning, self-motivation, and experiences of mastery. These models make use of certain strategies, such as cognitive restructuring, self-regulation, and positive affirmations, in order to have a direct impact on the self-beliefs and motivation of a person. Individual therapy sessions, individualised learning programs, and self-help tools are all ways in which such approaches might be put into practice. PSO models have the potential to indirectly improve social and emotional learning abilities like as communication, teamwork, and conflict resolution, which may subsequently contribute to the overall well-being and self-confidence of students.

2 Students' self-efficacy model based on social cognitive theory

Within the realm of social brain research and instructional methods, the social cognitive theory is one of the concepts that is taken into consideration to be out of date. Self-efficacy, observational learning, and ternary intuitive determinism are the three key components that make up its contents. Additionally, all of these components are interconnected. The concept, which is built on the internal features of the person as well as the external climate, is referred to by the phrases individual determinism and ecological determinism (Albert, 2019). Both of these names are used to characterise the concept. As shown in Figure 1, individual components, ecological factors, and social variables are all believed to be hypothetical objects that are capable of functioning freely and intelligently. Also included in this category are social variables.

The ability to assume responsibility and direct one's own actions is a product of an individual's subjective views and initiatives. When their subjective sentiments change, so do the outcomes of their behaviours. A person's subjective traits may be used to set off responses in their surroundings. In addition, people's responses to the many natural environments they encounter might alter their subjective perceptions. People may form a connection to their environment by the things they do. Teachers' confidence in their own abilities is directly proportional to the amount of stress they bring into the classroom. Teachers who have faith in themselves are more capable of handling challenges, adjusting to changes, developing self-awareness, and balancing professional and personal development. Everything that has transpired is a result of their improved ability to handle the pressures of their employment. Confident college students are more likely to choose a major that they love and persevere through tough times because they are able to make good professional decisions. Plus, they are better able to deal with the stresses that come with working. Dissatisfaction with one's work life, feelings of worthlessness, and increased rejection rates are all symptoms of college students' lack of self-confidence when it comes to making good professional decisions. This is because they have a lower level of competence when it comes to choosing a career route. By breaking down the operational definition into its component pieces, we may get a thorough grasp of how one makes judgments about their own career. A person's self-evaluation shows how well they understand and enjoy their job, how well they can do tasks, how much value they put on those abilities, and how much of an influence they have had in their professional lives. In addition, one's self-evaluation reveals their enthusiasm in and expertise about their chosen profession. At this point, people assess their work based on the data they gathered about themselves and their surroundings. To accomplish this, people think about all the possible jobs out there and assess how confident they are in their ability to advance in their current position. The amount of effort and determination an individual puts out while doing action is ultimately determined by their level of confidence. Individuals' beliefs about their own abilities to carry out different tasks effectively provide a reasonable explanation for the myriad considerations that go into choosing a career path. Decisions about one's career trajectory tend to be less daunting for those who have a strong feeling of effectiveness, to rephrase the original statement (Cristofaro, 2020). When it comes down to it, people make judgments about their careers after doing things like accepting themselves, learning as much as they can about the field, investigating potential employers, and assessing the pros and drawbacks of different options (Sverko and Babarovic, 2019). This is based on the idea that when humans plan their professional futures, they aim to maximise possible gain while minimising potential loss. This is where it all begins. As they consider their career options, students take into account many factors that make up the self-efficacy model. These parts are shown in Figure 2.

There is a correlation between an individual's capacity to gather information and their ability to gather information that is relevant to their job hunt. It should not be difficult for individuals to gain access to information concerning the growth prospects of the industry and the patterns of career development. Individuals' professional talents and hobbies have a key influence in the process of goal-setting, the decision-making process regarding careers, and the development of confidence. Individuals who are capable planners are able to plot a route for their professional lives, polish their craft, and advance in the fields that they have chosen to work in. When it comes to conquering challenges that people encounter in the course of their employment, the

ability to solve problems is essential. These challenges might be related to the dynamics of the family, the consensus of society, the economy, organisational hurdles, or any number of other reasons (Fu et al., 2021; Emtinan, 2018; Han et al., 2020; Hew et al., 2020).

Figure 1 Theoretical basis of social cognition (see online version for colours)

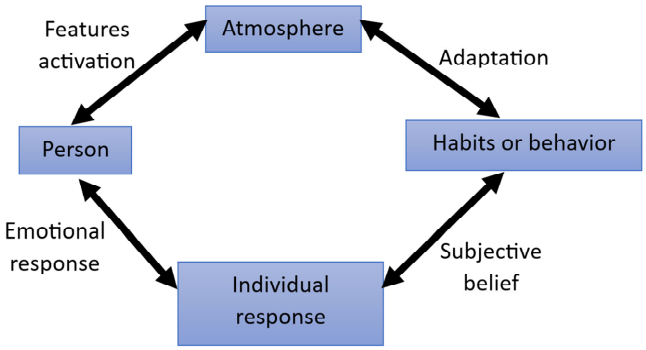
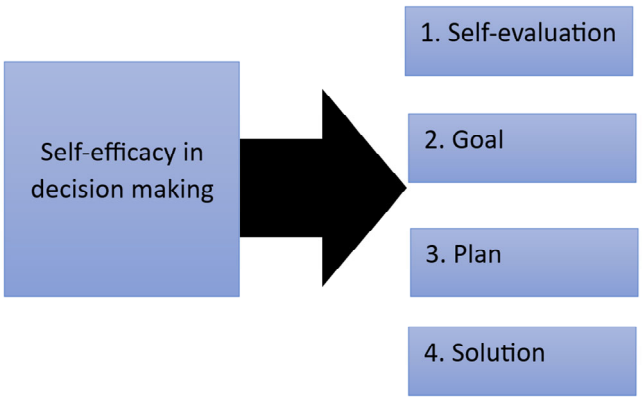


Figure 2 Self-efficacy in career decision-making (see online version for colours)



3 Student's implicit association with career decision-making

The idea that an individual's choice of professional path is influenced by both resources and barriers is a fundamental notion that is crucial to the field of social cognitive theory. Indirectly, the individual's self-efficacy and expectation of success have an effect on the individual's decision-making about their professional path. This is because these factors influence the individual's choice of objectives and behaviours, which in turn influences the individual's profession. The path that an individual's professional development will ultimately take is ultimately defined by the course that it will take. When it came to the student labelling groups that were based on labels and other approaches, the method of artificial division was the one that was utilised most frequently. Additionally, it is not capable of adequately representing the opinions of all types of students. In addition, it is challenging to exert control over the quantity of data belonging to defined categories while one is engaged in the process of making professional decisions. On the other hand, when there are a bigger number of categories from which to choose when making a profession selection, there are also a greater number of factors that are taken into consideration when making a decision about a vocation and evaluating it (Ray et al., 2019). In spite of this, it is difficult to exert control on the degree of granularity that this classification possesses. There is a wide variety of classifications that might be utilised for specific job paths for individuals. Through the process of system design, the formulation of the number of classes, which is also referred to as the number of implicit features, is done. In the event that there is a bigger number of implicit characteristics from which to select, the categorisation will be even more specific. The amount of implicit features that are present will decrease in proportion to the coarser the granularity of the classification. It is possible to ascertain the level of interest that students have in a particular field of employment by analysing the decision-making process that pertains to careers and the level of interest that students have individually. The formula for the computation is presented in the following manner:

$$I = \sum_{c} S_i B_j \tag{1a}$$

$$\delta = \sum_{s} A_i B_j \tag{1b}$$

Specifically, in formula (1b), I represents the degree of interest that students have in making profession decisions, c represents the total number of categories, S_i represents the level of interest that student i has, and B_i represents the weight that student j career decision carries. When the weight is greater, it suggests that the profession choice that is linked with it is more indicative of the implicit type. People seek out specialised support and assistance from a range of sources, such as their families, their peers, and their environments, in order to gain the support and assistance they require. The companionship of family members, the exchange of information among peers, the recognition of professional instructors, and other similar sources are included in this category. Additionally, it plays a role in the connection between an individual's self-regard and career advancement to a certain extent. This circumstance does not serve as a mediator between self-efficacy and career anxiety (Jeon et al., 2019). This is true regardless of the circumstances. Individuals who already have a high level of self-assurance in their work can further boost their sense of self-efficacy in the process of having to make judgments regarding their careers by effectively preparing themselves for professional decision-making. These individuals exhibit a higher degree of grounded flexibility in the job with the goal of taking their careers to the next level. As a consequence of this, their ability to adapt to changes in their job situations and to maintain a condition of balance in the face of such changes is increased (Shimoni et al., 2019). Based on the closest neighbour set of the individual roles that students play in their separate work fields or occupations, it is feasible to generate a prediction score for students regarding their professional decision-making. This score may be used to make predictions about the students'

professional decisions. In order to perform the computation, the formula is as follows:

$$p = avg_0 + \frac{\sum_{\mathbb{S}} (avg_0 - avg_s)}{\sum \mathbb{S}} \quad (2)$$

Formula (2) uses the following variables: p for the prediction score, avg_0 for the historical average score, and avg_s for the score of the neighbouring set. The variable s stands for the degree to which students are similar to the adjacent set. The students are provided with the maximum number of profession options based on the ranking of the scoring results. When it comes to making decisions about one's profession, self-efficacy acts as a mediator while also contributing to capacity building between work self-assurance and career adaptability. In the process of career advancement, it is common practice to emphasise the importance of building self-efficacy in professional decision-making (Trevor-Roberts et al., 2019). This is done with the goal of further expanding the career adaptability of individuals who have varying degrees of work self-assurance. In situations where the assistance we provide is unable to genuinely improve an individual's sense of self-efficacy in terms of career decision-making, these methods are fully interceded. As a result, the impact of their assistance on the interest in having a career will be hampered.

3.1 Cognitive capacity of students

In accordance with the social cognitive theory, the conditions that are external to the individual are the primary factors that have an impact on the outcome of the decision that an individual makes regarding their job. Consequently, the individual's aptitude for learning certain tasks and their considered belief that they are competent of performing a given activity are both very crucial variables in the decision-making process about their career. The fact that different people have different expectations for the same activity results in a variety of different professional advancement opportunities. The reason for this is that various people have different experiences, which in turn causes them to have diverse thoughts and expectations (Muoz, 2020). The simultaneous influence of professional cognition on the career interest of college students is determined by the intermediary path as well as the direct effect of social support. Both of these factors are accountable for the influence. It is the path that occurs when the two paths are joined that is referred to as the interim path. The fact that the mediator is successful is evidence of this particular point. There is a correlation between individuals who have a high degree of professional cognition and a higher level of confidence, which in turn might lead to an increased motivation in pursuing a career (Love et al., 2019). At the sub aspect level, there are a number of attributes that are connected to career cognition (María-José et al., 2021). There is a fundamental and unmistakable connection between the ideas of professional flexibility, career consideration, and career cognition and restrictions. In terms of making decisions about their professions, there is a considerable relationship between the career cognition of students and their sense of self-efficacy (Lee et al., 2021; Li et al., 2020; Liu et al., 2020; Lin et al., 2020). This will allow you to acquire both sets of data simultaneously. In conclusion, we have the framework for understudy professional cognition, which is defined by the fact that every student has the potential to acquire a career knowledge. All students have the ability to gain career knowledge. Upon simultaneously incorporating the time element into these two factors, the formula for the computation undergoes a transformation that results in the following form:

$$t = \frac{c_{career}(1 - kt_0)}{n_{career}} \quad (3)$$

The variables c_{career}, t. k, t_0, and n_{career} represent the students' historical career cognition, the number of historical career cognitions, and the time factor, respectively, in formula (3). There is a strong correlation between the amount of personal information students have and their professional aspirations. The students' cognitive abilities are evaluated based on the unique conditions that they are experiencing in their lives.

When people have the impression that they are receiving support and assistance from people outside of themselves in relation to their professional activities, their interest in jobs that correlate to those activities will increase. It is not necessary for the process to go via the transmission of self-efficacy in order to arrive at a decision regarding a career (Emirza et al., 2021). This is the reason for this statement. There is a correlation between professional cognition level and professional interest. A character quality that is relatively constant is the ability to respect one's own self-respect. Individuals who have various levels of self-regard exhibit a wide variety of self-efficacy in terms of making decisions regarding their vocational pursuits (Maleki-Saghooni et al., 2020; Pandita et al., 2021). Because of this, it is feasible for self-regard to have an effect on professional development through the intermediary component of self-efficacy in the process of making decisions regarding one's job (Simonsen and Rundmo, 2020). People who have an unquestionable level of self-assurance in their work have a higher level of self-efficacy when it comes to making decisions about their careers, and they also demonstrate a better degree of adaptability in their careers (Boswell and Sohr-Preston, 2020). This is a strong indication of the previous point. People with high levels of self-esteem are able to express a more positive impression of themselves and a better degree of appreciation of their own accomplishments. This is because they have a higher level of self-esteem. They are also more self-assured and capable of making decisions, which leads to a reduced level of anxiety when confronted with obstacles associated to job selection (Reeves and Chiang, 2019). In addition, they are more competent of making decisions.

4 PSO-based self-efficacy model

A person's level of self-efficacy in making decisions about their job can be a strong indicator of their individual career flexibility (Liu and Cai, 2020). For the purpose of addressing the aim capacity of the model, the particle swarm enhancement computation is applied in this research. Particle swarm computation is depicted Pseudocode, which shows the advancement of the calculation.

The particular PSO method incorporates elements such as the definition of particles, the fitness function, the size of the swarm, the rules for updating velocity and location, and any particular variants or adjustments that are used. The modifications that were brought about for the self-efficacy model may shed insight on the manner in which the selected PSO components were adapted to handle issues of self-belief and motivation within the setting of education. Changes in the representation of particles, the design of fitness functions, feedback systems, or interaction rules within the swarm might be necessary under certain circumstances. This particular PSO form was chosen because it is based on research and context, which can examine the reasons for picking this particular variation over other PSO algorithms. The research and context are the basis for this selection.

There are a number of parameter options that may have a substantial influence on the performance of PSO. Some examples of these variables are the inertia weight, acceleration coefficients, and swarm size. It is possible to modify PSO in order to accommodate the management of constraints by using techniques such as boundary handling or penalty functions. PSO has the potential to greatly improve performance when combined with other optimisation methodologies. There is a large number of different versions of PSO, and each of these variations has its own distinct set of rules for updating the velocity, neighbourhood structures, and selection procedures.

4.1 Pseudocode for PSO

Step 1 Initialise

- Define the problem space (dimensions, bounds).
- Create a swarm of particles (random positions and velocities).
- Assign random personal best positions (pbest) to each particle.
- Initialise a global best position (gbest).

Step 2 Evaluate fitness

- Calculate the fitness value for each particle's current position.

Step 3 Update velocities

- For each particle:
  - a Calculate velocity update based on:
    1 current velocity
    2 distance to pbest
    3 distance to gbest.
  - b Apply inertia weight to balance exploration and exploitation.
  - c Limit velocity to a maximum value to prevent particles from flying out of bounds.

Step 4 Update positions

- For each particle:
  - a Update its position based on its new velocity.
  - b Ensure position stays within bounds.

Step 5 Update personal bests

- If a particle's new position has a better fitness than its pbest, update pbest.

Step 6 Update global best

- If any particle's pbest is better than gbest, update gbest

Step 7 Repeat steps 2–6 until a termination criterion is met

- Common criteria:
  - a Maximum number of iterations.
  - b Convergence of fitness values.
  - c Satisfying solution quality.

It is deemed to be a component of the issue, according to the definition of a discrete problem, that the self-efficacy model for student career decision-making constitutes a component of the problem. Within the scope of this investigation, the binary PSO strategy is used with the intention of mapping the continuous search space to the binary discrete space that is being explored. It is necessary to make use of the sigmoid mapping function in order to convert the value of the particle velocity into the chance of the bit being taken by 1. The particle position is brought up to date by doing this, which is why it is essential.

By making advantage of the information that we have on the evolutionary state, we are able to effectively increase the convergence performance of the algorithm. This enables us to accomplish what we set out to do. During the calculation, the advancement state factor is responsible for determining the limits that are placed on the development condition of each age group. This particular aspect is the one that is accountable for establishing the conditions. When the coding characteristics of the binary PSO approach are taken into account, the hamming distance value is used to represent the distance that exists between them. This is done in order to keep track of those features.

College students' sense of self-efficacy in making career decisions mediates the relationship between their social support network and their professional interests, even though this relationship is not entirely consistent among pathways (Zhou and Luo, 2019). College students' interest in continuing a career path is indirectly increased by career social support, which enhances an individual's professional self-efficacy in decision-making – all thanks to the beneficial function that self-efficacy performs in this

process (Hou et al., 2021). Career flexibility refers to an individual's ability to adapt to and stay balanced with changes in their chosen occupations. When considering a professional path, self-efficacy is the degree to which a person believes in their own abilities and experiences to succeed in that field (Peng et al., 2021; Wilson et al., 2020; Wong, 2020; Xu et al., 2021; Yang et al., 2021; Zhai et al., 2020). It follows that persons who believe in their own abilities to make good job decisions are more likely to take charge of their own professional destinies and to excel at what they do for a living.

Having an understanding of the unique environment in which the PSO model was applied (for example, a science lesson for students in grades K-12 or an engineering program for students in higher education) helps me comprehend the relevance and generalisability of the findings. For the purpose of conducting an accurate assessment of the efficacy of the model, it is essential to provide a clear definition of the particular kinds of learning opportunities and decision-making abilities that the research intended to enhance. For the purpose of drawing conclusions regarding the success of the PSO algorithm, it is essential to have a thorough understanding of the method for the particular application and to appropriately apply it.

5 Experiment

5.1 Experimental preparation

On the basis of social cognitive theory, this article proposes a self-efficacy model as a means of assisting students in making decisions about their future careers. All that follows is an effort to determine whether or not the model is viable. Within the context of the option, variables such as orientation, grade, and beginning point are altered in order to modify the influence of the personal features of the persons on the feeling of self-efficacy that is associated with making choices about their careers. Hierarchical selection is the precise approach that is being used in order to guarantee that the sample has an equal number of individuals belonging to both genders, grades, and two different categories of origin. All calculations are coded in MATLAB, and the exploration environment is a Windows 10 working framework (Intel Core i5-4570 processor with a main frequency of 3.20 GHz and 8 GB of RAM).

5.2 Experimental results and analysis

The purpose of this article is to investigate the prevalence of the model by comparing the results of the assessment that used the self-efficacy model in career decision-making in light of group examination and client representation with the findings of the assessment. One thousand and five thousand pupils participated in the examination. To begin, it is necessary to determine whether or not any model is structurally sound. For the purpose of quantifying structural validity, the KMO index was used. The results of the comparison tests are shown in Tables 1 and 2, respectively. The average results for validation is plotted in Figure 3.

Table 1 Validation of the model's structure with 1,000 students

Number of experiments	*Proposed self-efficacy model for career decision making/%*	*Self-efficacy model for career decision making (cluster analysis)/%*	*Self-efficacy model for career decision making (portrait analysis)/%*
1	0.907	0.829	0.833
2	0.910	0.822	0.839
3	0.897	0.842	0.848
4	0.904	0.841	0.823

Table 2 Validation of the model's structure with 5,000 students

Number of experiments	*Proposed self-efficacy model for career decision making/%*	*Self-efficacy model for career decision making (cluster analysis)/%*	*Self-efficacy model for career decision making (portrait analysis)/%*
1	0.871	0.820	0.821
2	0.880	0.814	0.831
3	0.887	0.817	0.815
4	0.863	0.829	0.819

Table 3 Reliability of the model's structure with 1000 students

Number of experiments	*Proposed self-efficacy model for career decision making/%*	*Self-efficacy model for career decision making (cluster analysis)/%*	*Self-efficacy model for career decision making (portrait analysis)/%*
1	0.863	0.778	0.769
2	0.848	0.781	0.775
3	0.872	0.787	0.771
4	0.878	0.782	0.785

Table 4 Reliability of the model's structure with 5,000 students

Number of experiments	*Proposed self-efficacy model for career decision making/%*	*Self-efficacy model for career decision making (cluster analysis)/%*	*Self-efficacy model for career decision making (portrait analysis)/%*
1	0.801	0.702	0.711
2	0.806	0.700	0.721
3	0.790	0.708	0.713
4	0.798	0.720	0.718

Figure 3 Plot for validation average (see online version for colours)

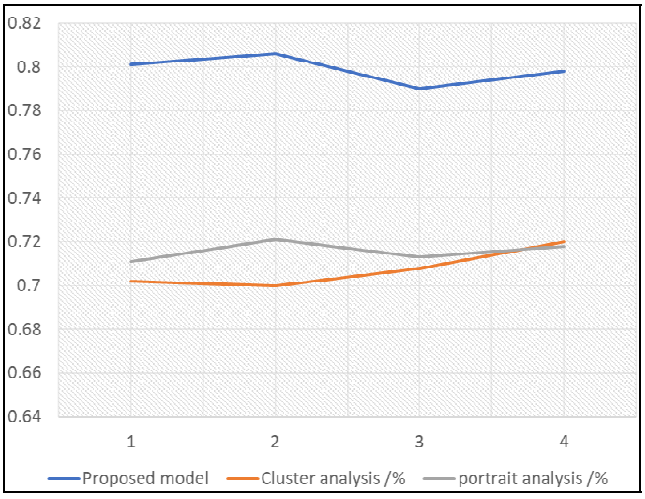
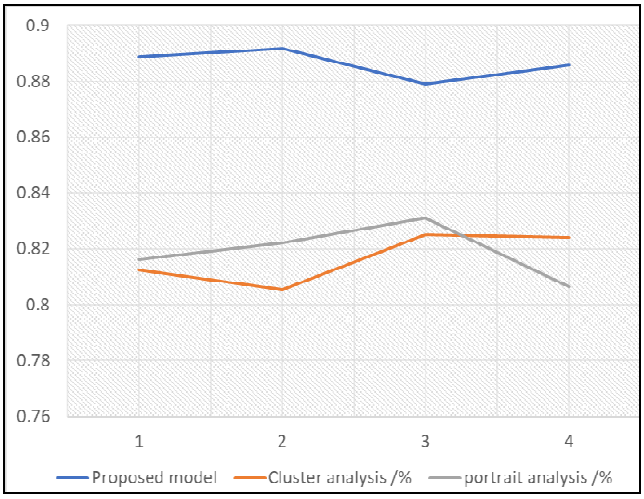


Figure 4 Plot for reliability average (see online version for colours)



There is a higher level of significance associated with the self-efficacy model presented in this paper when contrasted with the cluster-analysis-based career decision-making approach. In order to guarantee that the results of the test are accurate, the photograph of the user is formatted in the suitable manner. When compared to the model that is based on cluster analysis and user portrait, this one has a higher structural validity in the amount of 0.858, which is 0.054 and 0.053 higher, respectively, when tested with an experimental sample of 5,000 students. In the following step, we examine the reliability of each single model. Cronbach's α index was utilised in order to quantify the overall dependability of the data. Both Tables 3 and 4 present the results of the comparative tests that were conducted previously. The average results for reliability are plotted in Figure 4.

The self-efficacy model that was produced in this research is much more reliable than the cluster-analysis and user portrait–based career decision-making model, according to the findings of the reliability test that was conducted. We are able to draw this conclusion based on the findings of the test. The following is the conclusion that may be drawn from the fact that the reliability test was successful. When compared to the model that is based on cluster analysis and user portrait, this one has a reliability of 0.815, which is 0.093 and 0.084 higher, respectively, than the other model. This number has shown a significant improvement in recent times. Comparatively speaking, the prior number was not quite as significant as this one. In order to illustrate this point, the findings of the experimental test that was conducted with 5,000 students shown that this model performed better than the others in terms of dependability. This model, as a result, satisfies stringent validity requirements and effectively analyses students' confidence in their capacity to make rational judgments while they are engaged in their task. The choice that they make about their job path is a very significant one for them to make.

6 Conclusions and future work

The capacity of a professional to evaluate whether or not he is capable of performing a job task based on his own sense of competence is referred to as 'self-efficacy' in the context of career decision-making. Self-efficacy is a fundamental concept in the field of career management. Self-efficacy is one of the most essential characteristics that can have an influence on the smooth progression of career activities. Therefore, when it comes to making decisions about one's job, self-efficacy is one of the most crucial factors. It is also possible for it to have an impact on the outcome of the employment decision that an individual makes. In addition to having a high level of structural validity and detection reliability, the self-efficacy model that was proposed also has a good level of compatibility with the data as a whole, which reaches an acceptable level. For the goal of doing additional research on self-efficacy model-based career decision-making, it is recommended that future study pick participants from a wide range of geographical areas, urban populations, age groups, and professional foundations.

There are issues involved in accurately collecting and reflecting the dynamic and diverse character of self-efficacy via the use of student data. In order to model sophisticated learning and decision-making abilities inside the PSO framework, such as goal setting, strategy selection, and problem-solving, more refining may be required. When student self-efficacy and learning processes are reduced to particle motions and fitness functions inside the PSO algorithm, it is possible that this may result in simplifying and a loss of subtlety. One possible limitation of the model is that it may have difficulty taking into account individual variations in learning styles, motives, and social-emotional elements that influence student actions.

A number of challenges may arise when attempting to successfully incorporate the PSO model into pre-existing educational methods and to adapt it to a variety of classroom situations. Taking into account additional factors is necessary in order to guarantee scalability and cost-

effectiveness for big student groups and a variety of educational experiences.

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