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ORIGINAL STUDY

Information Processing Styles, Problem Solving, and Their Relationship with Metamotivation and Perceived Control among Postgraduate Female Students

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Abstract

The demands of professional, scientific, and academic life have made it necessary to identify the various difficulties faced by postgraduate female students, which lead to problems that hinder their achievement of the required goals. This necessitates directing efforts toward finding solutions to confront and solve problems through appropriate cognitive behavior. Therefore, this study aimed to identify information processing styles and problem-solving and their relationship with metamotivation and perceived control among postgraduate female students (PhD/Master's). To achieve this aim, the descriptive approach using the survey method was adopted due to its suitability to the nature of the research problem. The population was defined as postgraduate female students (PhD and Master's) for the academic year 2023–2024 at the College of Physical Education and Sports Sciences for Women, numbering (43 students): (20 PhD) and (23 Master's). Data were analyzed using (SPSS), Pearson correlation coefficient, Cronbach's alpha coefficient, arithmetic means, and standard deviations for statistical data processing. The findings revealed that postgraduate female students possess the abilities in (information processing styles / problem solving / metamotivation / perceived control). Accordingly, the study recommends the necessity of paying attention to providing course materials that stimulate postgraduate students' desire to use multiple methods appropriate to information processing styles, problem solving, metamotivation, and perceived control, for the purpose of developing and improving their academic performance, and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Good Health).

Keywords: Information processing styles, Problem-solving, Metamotivation, Perceived control

1. Introduction

Postgraduate students in universities are the leaders of the future; therefore, scientific progress has imposed upon us the necessity of paying attention to this important segment of society and developing it in various scientific and practical fields. Accordingly, the demands of professional, scientific, and academic lives have made it necessary to identify the difficulties faced, particularly by postgraduate female students in

the College of Physical Education and Sports Sciences for Women during the 2023–2024 academic year, which lead to problems that hinder their achievement of the required goals. At that point, the necessity arises to direct efforts toward finding solutions to confront problems through a set of “directed cognitive mental activities according to organized and planned methods for organizing and representing previous experiences and the elements of situations to which the individual is exposed, and the elements they involve,

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in order to achieve the goal of overcoming obstacles and solving problems” (Salah Al-Din, 2001). Thus, problem solving is the appropriate cognitive behavior for dealing with problems rather than focusing on the cognitive process.

Since the concept of information processing refers to a set of transformation processes that occur to the information we receive through the senses until the response appears, whether from the procedures preceding its occurrence within the framework of mental processes or from the stimuli themselves, and since the human mind is the one that receives information, modifies its form and content, and stores it, information processing requires collecting information, representing it, encoding it, retaining it, and retrieving it when needed through control processes.

Therefore, information processing and problem solving in the educational domain require higher cognitive skills, represented by good memory for storing and organizing information and motivation for knowledge, as metamotivation contributes effectively in educational situations by directing behavior toward goals and helping to increase perseverance, effort, and energy, along with enhancing the capacities for information processing, which are reflected in the objectives of the learning process.

One of the important processes for female learners in the classroom is the ability to perceive concepts and apply knowledge by using perceived control, as it is one of the key determinants of learning. In addition it is among the judgments that are not related only to what the student accomplishes. Rather, it refers to judging what she accomplishes through self-evaluation of what she can perform. This includes the degree of perseverance and effort exerted in order to deal with difficult and complex situations and the degree of resistance to failure. Based on the above, the researchers consider it necessary to conduct a study to identify information processing styles and problem solving and their relationship with metamotivation and perceived control among postgraduate female students (PhD/Master’s) at the College of Physical Education and Sports Sciences for Women for the academic year (2023–2024), in order to contribute to providing learners with information that serves their learning level. As for the research problem, it was crystallized through the researchers’ experience as instructors of postgraduate female students at the College of Physical Education and Sports Sciences for Women, University of Baghdad (Master’s/PhD). Through their engagement with the educational setting, their personal experiences, and daily observations, they found the presence of many academic problems, which ultimately reflect a weakness in important and effective cognitive abil-

ities, including information processing styles that help in problem solving and their relationship with metamotivation and perceived control among postgraduate female students (PhD/Master’s).

The aim of the current research is to identify information processing styles and problem solving and their relationship with metamotivation and perceived control among postgraduate female students (PhD/Master’s) for the academic year 2023–2024 at the College of Physical Education and Sports Sciences for Women/University of Baghdad. To verify the research aim, the following two hypotheses were formulated: Does the sample possess the research variables (information processing styles, problem solving, metamotivation, and perceived control)? Is there a correlation between information processing styles, problem solving, metamotivation, and perceived control among the members of the research sample?

The human domain included postgraduate female students (PhD and Master’s) for the academic year 2023–2024 at the College of Physical Education and Sports Sciences for Women/University of Baghdad. The temporal domain was from (9/10/2023) to (28/12/2024), and the spatial domain was the classrooms of postgraduate female students at the University of Baghdad/College of Physical Education and Sports Sciences for Women/Al-Waziriyah.

2. Methodology

The descriptive approach using the survey method was adopted to suit the nature of the study problem. The study population was exclusively defined as postgraduate female students (PhD and Master’s) during the academic year 2023–2024 at the College of Physical Education and Sports Sciences for Women, with a total number 43 students (20 PhD and 23 Master’s). The researchers relied on two scales for information processing styles and problem solving (Al-Badri, 2015). They also used two additional scales by Al-Gharbawi (2019) to measure metamotivation and perceived control after making certain modifications to the items to fit the variables of the study and its sample.

Statistical methods were used, including arithmetic means, standard deviations, Pearson correlation coefficients, the t-test, and Cronbach’s alpha coefficient, as they were appropriate for the study variables. Data results were obtained using the Statistical Package for the Social Sciences (SPSS).

2.1. Field procedures

The scale by Al-Badri (2015) was selected to measure information processing styles. The scale included

Table 1. Shows the arithmetic means, standard deviations, and skewness coefficient values of the studied variables among PhD female students.

Variables	Mean	Median	Standard Deviation	Skewness Coefficient	Distribution
Information Processing Styles	198.11	195	23.792	0.392	Normal
Problem Solving	148.42	150	27.527	-0.172	Normal
Metamotivation	159	162	18.549	-0.485	Normal
Perceived Control	107	105	16.483	0.364	Normal

Table 2. Shows the arithmetic means, standard deviations, and skewness coefficient values of the studied variables among Master's female students.

Variables	Mean	Median	Standard Deviation	Skewness Coefficient	Distribution
Information Processing Styles	196.73	190	30.888	0.653	Normal
Problem Solving	155.08	150	27.947	0.545	Normal
Metamotivation	152.78	148	23.088	0.621	Normal
Perceived Control	107.69	109	13.559	-0.289	Normal

Table 3. Shows the calculated (T) values between the arithmetic means and the hypothetical means of the studied variables among PhD female students.

Variables	Mean	Standard Deviation	Hypothetical Mean	Calculated t Value	Sig.	Statistical Significance
Information Processing Styles	198.11	23.792	150	9.266	0.000	Significant
Problem Solving	148.42	27.527	120	4.731	0.001	Significant
Metamotivation	159.00	18.549	108	12.598	0.000	Significant
Perceived Control	107.00	16.483	84	6.394	0.000	Significant

•Statistically Significant if $p < 0.001$.

Table 4. Shows the calculated (T) values between the arithmetic means and the hypothetical means of the studied variables among Master's female students.

Variables	Mean	Standard Deviation	Hypothetical Mean	Calculated T Value*	Sig.	Statistical Significance
Information Processing Styles	196.73	30.888	150	7.255	0.000	Significant
Problem Solving	155.08	27.947	120	6.019	0.001	Significant
Metamotivation	152.78	23.088	108	9.300	0.000	Significant
Perceived Control	107.69	13.559	84	8.379	0.000	Significant

•Statistically Significant if $p < 0.001$.

(52 items) with response alternatives (strongly agree, agree, neutral, disagree, and strongly disagree). Furthermore, the problem solving, which included (40 items) with response alternatives (applies to a very large degree, applies to a large degree, applies to a moderate degree, applies to a low degree, does not apply at all). Moreover, the scale by Al-Gharbawi (2019) were selected to measure metamotivation. It included (36 items) with response alternatives (always, often, sometimes, rarely, never). In addition, the perceived control scale included (28 items) with response alternatives (always, often, sometimes, rarely, never). The items of the four scales (information processing styles, problem solving, metamotivation and perceived control) were modified according to the characteristics of the studied population. Finally, the revised items were administered to a panel of experts and specialists. The experts reached (100%) agreement, confirming the content validity of the modified scales. To Examine the validity and reliability of the scales, a pilot study was conducted with ten female students. Reliability coefficients of the four scales were 0.869, 0.882, 0.911 and 0.854 accordingly. This means the scales level of reliability was high because

all coefficients were significant at 0.05 level. The scales had Cronbach's alpha values of 0.921, 0.842, 0.876, and 0.852 respectively.

2.2. Pilot study

The pilot study was conducted on (5) female students after completing the process of preparing the scales according to the research procedures, in order to identify the difficulties that the researchers might face, the extent to which the sample understood the items of the scales and the test, and the time required to apply the scales and extract the values of the scientific bases. As for the main experiment, the application was carried out on the members of the study sample after more than 30 days had passed since the pilot study and within the same time frames as the pilot study.

3. Presentation and discussion of results

As illustrated in Table 1 and Table 2, the skewness coefficients for the study variables ranged from ± 1 . For that reason, the data follow a normal distribution.

Table 5. Shows the correlation coefficient values between the studied variables among the members of the research sample.

Variables	Calculated r Value with Metamotivation*	Sig.	Statistical Significance	Calculated r Value with Perceived Control	Sig.	Statistical Significance
Information Processing Styles	0.599	0.001	Significant	0.642	0.000	Significant
Problem Solving	0.685	0.001	Significant	0.711	0.001	Significant

•Statistically Significant if $p < 0.001$.

Table 6. Shows the calculated (T) values between the two research groups (PhD–Master's) in the research variables.

Variables	PhDX	PhD S	Master'sX	Master's S	Calculated T Value*	Sig.	Statistical Significance
Information Processing Styles	198.11	23.792	196.73	30.888	0.566	0.231	Not significant
Problem Solving	148.42	23.527	155.08	27.947	3.590	0.001	Significant
Metamotivation	159	18.549	152.78	23.088	3.362	0.001	Significant
Perceived Control	107	16.483	107.69	13.559	0.522	0.168	Not significant

•Statistically Significant if $p < 0.001$.

It is clear from the results of the two tables above that there are significant differences when comparing the arithmetic mean values with the hypothetical mean values. This indicates that PhD and Master's female students possess information processing styles, as they represent the natural pathway of memory and intelligence for dealing with academic materials and forming conclusions independently. This occurs through the role of instructors in facilitating the learning process and providing them with the activities and tools necessary for learning, as well as their ability to process information through attention and directed thinking to solve problems, and their ability to generate alternatives to make appropriate decisions for solving problems due to their possession of experience and their ability to set goals after analyzing them. Moreover, metamotivation increases the effectiveness of expectations of success and achievement by increasing their interest in learning and the importance of their work, enhancing their self-esteem, and strengthening their ability to respond to different events and deal flexibly with various situations in order to achieve positive adjustment, understand the educational learning environment surrounding them, and control events in their favor.

As for the results of the above Tables 3 to 6, it shows that all members of the two research samples possess ability and effectiveness through the correlation relationship among the study variables, as they have their own styles of information processing as a result of the variation in learning situations from time to time during lectures. These results also indicated the advancement of the students in information processing as a result of selective attention through directed thinking toward problem solving by generating alternatives to make appropriate decisions. The results further indicated their ability in many aspects of cognitive processes to make decisions after setting goals, clas-

sification, judgment, and analysis in order to reach them with effective expectation, as stated by [Chen \(1995\)](#) "The high level of metamotivation among university students is achieved through awareness, confidence, attention, satisfaction, and relevance to the subject, which motivates the learner and increases motivation to complete the learning process."

In addition, the nature of the students in terms of their ability to respond to events, maintain themselves, and deal flexibly with different situations contributes to positive adaptation and understanding of the surrounding environment. This is confirmed by [Jarwan \(1999\)](#) "When students recognize the solution, this forms their perception that they possess the knowledge and ability to solve the problem successfully through their beliefs that they are influential in themselves and their surrounding environment, which supports them in facing various life problems."

The results of the above table, which show the variance between the results of PhD and Master's female students, can be interpreted as not being statistically significant in (information processing styles and perceived control). This may be attributed to the absence of differences between PhD and Master's female students in educational experience and differences in the capacity of the application system that mediates between the perceptual system and the memory system, in addition to the weaker ability of Master's female students compared to PhD female students in terms of identifying important information styles, receiving information, analyzing it, classifying it, and determining the priority of transfer from the perceptual system to the memory system.

Meanwhile, the significance of (problem solving and metamotivation) is attributed to the ability and efficiency of memory in activating the information network to select and implement appropriate methods for processing and solving problems. This is consistent with several previous studies ([Adam, 2005](#);

Al-Maghribi, 2001; Rashwan, 2003; Eberman & McKelvie, 2002), which indicate that what the learner performs in terms of processing, operations, or representations of academic material—such as repetition, organization of mental images, awareness, etc.—increases the ability and efficiency of most mental processes in general and working memory in particular.

Conclusions

In light of the obtained results, the researchers reached the following conclusions:

- Postgraduate female students (PhD/Master's) at the College of Physical Education and Sports Sciences for Women for the academic year (2023–2024) possess the abilities of (information processing styles/problem solving/metamotivation/perceived control).
- There are correlation relationships between (information processing styles/problem solving) and (metamotivation), and between (information processing styles/problem solving) and (perceived control) among the members of the two research samples.
- There are no statistically significant differences between PhD and Master's female students in (information processing styles and perceived control).

Recommendations

Based on the results of the study, the researchers recommend the following:

- The necessity of paying attention to providing course materials that stimulate postgraduate students' desire to use multiple methods appropriate to information processing styles, problem solving, metamotivation, and perceived control, for the purpose of developing them and improving their academic performance.
- Providing an appropriate environment for information processing styles, problem solving, metamotivation, and perceived control in order to develop and improve academic performance.
- Taking into account individual differences among students, especially in (information processing styles/problem solving/metamotivation/perceived control).
- Paying attention to scientific aspects through scientific activities that keep pace with scientific progress and what modern technology and the information age impose.

Conflicts of interest

None.

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Ethical-clearance

This manuscript approved by the Scientific Committee of the College of Physical Education and Sports Sciences for Women, University of Baghdad, Iraq, on (09/10/2023).

Author's contributions

All contributions to this study were carried out by the researchers as follows: **Prof. Dr. Intisar Owaid Ali** conducted the study procedures, collected and organized the data, and participated in drafting the manuscript. **Prof. Dr. Fatimah Abed Malih** developed the research idea, designed the study, supervised the research procedures, interpreted the results, and reviewed and finalized the manuscript. **Prof. Dr. Abeer Dakhil Hatem Al-Selmi** contributed to data analysis, participated in the implementation of the research procedures, and assisted in drafting the manuscript. **Prof. Dr. Andriy Vovkanych** contributed to scientific revision, provided academic consultation, and reviewed the manuscript, with the assistance of a number of experts. **Asst. Lect. Inam Al-Azzawi** in Translation.

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Roles of each researcher in the research

Prof. Dr. Intisar Owaid Ali conducted the study procedures, collected and organized the data, and participated in drafting the manuscript. **Prof. Dr. Fatimah Abed Malih** developed the research idea, designed the study, supervised the research procedures, interpreted the results, and reviewed and finalized the manuscript. **Prof. Dr. Abeer Dakhil Hatem Al-Selmi** contributed to data analysis, participated in the implementation of the research procedures, and assisted in drafting the manuscript. **Prof. Dr. Andriy Vovkanych** contributed to scientific revision, provided academic consultation, and reviewed the manuscript, with the assistance of experts in specific fields.

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Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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اساليب معالجة المعلومات وحل المشكلات وعلاقتها بما وراء الدافعية والتحكم المدرك لطالبات الدراسات العليا

انتصار عويد علي، فاطمة عبد مالح ، عبير داخل حاتم السلمي، أندرية فوفكانيتش

المستخلص

فرضت متطلبات الحياة المهنية والعلمية والأكاديمية ضرورة التعرف على مختلف الصعوبات التي تواجه طالبات الدراسات العليا، والتي تؤدي إلى نشوء مشكلات تعيق تحقيق الأهداف المطلوبة. لذلك، أصبح من الضروري توجيه الجهود نحو إيجاد حلول مناسبة لمواجهة هذه المشكلات وحلها من خلال السلوك المعرفي الملائم. وعليه، هدفت هذه الدراسة إلى التعرف على أساليب معالجة المعلومات وحل المشكلات وعلاقتها بما وراء الدافعية والتحكم المدرك لدى طالبات الدراسات العليا (الدكتوراه/الماجستير). ولتحقيق هذا الهدف، تم اعتماد المنهج الوصفي بالطريقة المسحية لملاءمته طبيعة مشكلة البحث. وتكون مجتمع البحث من طالبات الدراسات العليا (الدكتوراه والماجستير) للعام الدراسي 2023-2024 في كلية التربية البدنية وعلوم الرياضة للبنات، والبالغ عددهن (43) طالبة، منهن (20) طالبة دكتوراه و(23) طالبة ماجستير. وأظهرت النتائج أن طالبات الدراسات العليا يمتلكن قدرات في أساليب معالجة المعلومات، وحل المشكلات، وما وراء الدافعية، والتحكم المدرك. وبناءً على ذلك، توصي الدراسة بضرورة الاهتمام بتقديم المواد الدراسية التي تحفز طالبات الدراسات العليا على استخدام أساليب متعددة تتناسب مع أساليب معالجة المعلومات، وحل المشكلات، وما وراء الدافعية، والتحكم المدرك، بما يساهم في تطوير أدائهن الأكاديمي وتحسينه، وهذا ما يحقق أحد أهداف التنمية المستدامة للامم المتحدة في العراق (الصحة الجيدة).

الكلمات المفتاحية: اساليب معالجة المعلومات، حل المشكلات، ما وراء الدافعية، التحكم المدرك.