Information Sciences Letters
An International Journal

http://dx.doi.org/10.18576/isl/121109

Differential Item Functioning Analysis of an Emotional Intelligence Scale for Human Resources Management at Sohar University

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Received: 25 Aug. 2023, Revised: 10 Oct. 2023, Accepted: 20 Oct. 2023.
Published online: 1 Nov. 2023.

Abstract: This study aimed to investigate to what extent the item responses of Emotional Intelligence Scale form a unidimensional construct and local independence according to the Rasch model. It also aims at investigating the presence of DIF in terms of gender in the Emotional intelligence scale. The researcher adopted a descriptive survey method and collected data from a stratified random sample of Sohar University employees. The sample consisted of (396) employees. The researcher developed a scale of two dimensions, personal efficiency and social competence. The win steps program was used for statistical analysis of the data. The results indicated that both Rasch assumptions (unidimensional and local independence) are held in the present research. The results displayed DIF in terms of gender in some items in the Emotional Intelligence Scale. Several recommendations were presented on the basis of the finding.

Keywords: Rasch Model, Differential Item Functioning, Human Resources Management, Emotional Intelligence, Sohar University.

1 Introduction

Emotional Intelligence has received considerable attention recently. Referring to the literature and heritage of philosophical and psychological, we find that scientists and philosophers considered Emotional Intelligence as a true guide for foresight and wisdom. The difficulty of measuring intelligence is not only that it is intangible, but that it is also an abstract concept that is difficult to define. Intelligence is not only limited to the individual's mental abilities, or the extent of his ability to link ideas and information or deduce them, but it exceeds to reach the skills of success and happiness in the individual life. Scientists called these skills the "emotional intelligence". They began conducting research on it so that they can understand the human personality, developing their educational and creative abilities, raising the level of their work and production, and training humans to adapt within their society. So و the person who can't be able to deal with daily pressures, will may be susceptible to mental illnesses [1].

Because of the importance of emotional Intelligence, the actual need to prepare and build scales with a high level of accuracy and objectivity has increased recently. Achieving a high level of accuracy and credibility when constructing a scale needs to follow measurement theory. Classical test theory was used in the construction of scales with limit desired benefits. It depended on the analysis of the items of the scale on the characteristics of the individuals' sample, thereby reducing their consistency, Influence and flexibility [2-3]. Inadequacy in classical theory has led to the efforts of scientists in measurement and educational evaluation; To move to the use of item response theory or modern theory, which has received the attention of many researchers because it has eliminated many of the problems and disadvantages found in classical test theory such as test calibration (Equating Tests), the construction of items banks (Item Banks), the building of referenced tests (Criterion Referenced Tests) and adaptive tests (Adaptive Testing) [4-6].

Emotional Intelligence is a term used in psychology to refer to the ability to understand and perceive personal and others' emotions, how to control them, and effectively use them in interactions with people and the surrounding environment. This concept has been developed through research and studies in psychology and human behavior [7-9]. Some educational experts [9-11] see that emotional intelligence includes several key elements, including:

- **Self-awareness:** The ability to recognize your own feelings and emotions, understand their sources, and their impact on your behavior and decisions.
- **Emotion Regulation:** The ability to control emotional reactions and deal with them in a constructive and healthy

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manner.

- **Self-motivation:** The ability to motivate oneself and work towards achieving personal goals and aspirations effectively.
- **Empathy:** The ability to understand the feelings and needs of others and express empathy and support.
- **Social Skills:** The ability to build positive and healthy relationships with others, resolve conflicts, and collaborate effectively.

Emotional intelligence is considered an important skill in both personal and professional life, as it can help improve social and work interactions and enhance leadership and decision-making. Emotional intelligence can be developed through learning and training and is an area that is gaining increasing attention in personal and professional environments [3, 12].

Problem Statement

Regarding to the Strategic Plan 2018-2023 for Sohar University; the emotional intelligence plays an important role in the management of human resources at the Sohar University, both at the polarization level and in order to increase the efficiency of its personnel, as the effective human components of increasing productive efficiency and raising the University's intellectual progress. This underscores the importance of building psychological scales for human resources, which will increase the level of performance and create favorable working conditions for human relations, achieve work confidence and job satisfaction. This will promote initiative and readiness for change and creativity. Therefore, developing the quality of the work environment, achieving the highest possible productivity, as well as raising the scientific level of the university. The item response theory aims to identify the relationship between the responses of individuals on a given scale and the underlying feature, with a view to reaching the level of abilities of individuals away from the characteristics of the items. This is what modern theory of measurement seeks to define items away from their association with the characteristics of individuals, which is called in the item response theory "the non-covariance". This can be done by finding the parameters or abilities of individuals away from the characteristics of items (difficulty, discrimination, guessing), as well as the characteristics of items away from individuals' abilities. It is also based on a set of assumptions and models called latent trait models. There is a mathematical formula for each model, so as to determine an individual's performance relationship with his or her ability to underlie such performance and interpret it on each item of the scale [9].

Research Questions

This study seeks to answer the following two questions:

1. To what extent do the item responses of Emotional Intelligence Scale form a unidimensional construct and local independence according to the Rasch model?
2. Is participants' gender a source of DIF in Emotional Intelligence Scale items?

Research Objectives

The present study aims to investigate to what extent the item responses of Emotional Intelligence Scale form a unidimensional construct and local independence according to the Rasch model. In addition to investigating the presence of DIF in terms of gender in the Emotional intelligence scale.

Literature Review

Emotional Intelligence and Human Resources Management

The interest in human resources management as a specialized management function and as a branch of the Department's science reflects how important this aspect is in different areas of life. Human resources are the core of various organizations. They must therefore be cared for by focusing on their emotional intelligence as the foundation of a successful personality, one of the fundamental variables that increase the efficiency of institutional performance. People who are accurately aware of their feelings and emotions and work as a team; They have a range of complementary skills, and try to succeed with excellence in the jobs, projects and goals set by their institutions, because of what these effective teams enjoy, regardless of technical skills, but also with emotional skills, such as emotional awareness and emotional management skills based on the balance of emotion and mind in order to maximize long-term happiness [7-8, 13].

High emotional intelligence teams are more creative, more collaborative and effective, helping each other, and can distinguish their work in order to improve the results of the team and the organization as a whole. They can face conflict more constructively if there is a difference of views and they can accept a diversity of views. Teams with high

emotional intelligence are also skillfully engaged in managing and making the most of characters within the team, taking care of both work and feelings, and organizing feelings in the team among other members. Emotional intelligence in the team plays a major role in building trust, respect and understanding among members, which can lead to better participation and cooperation, thus making better decisions, productivity, creative solutions and a thriving working environment in general [11-13].

It is noted that everyone in the team has an important role to play in the overall level of emotional intelligence. With the Director's contribution, higher emotional intelligence outcomes are achieved, motivated by: The achievement campaign, which means "the continuous pursuit of improvement or the fulfillment of the criterion of excellence", is also the commitment to "align with the objectives of the group or organization", the initiative of "preparing the individual himself to work on opportunities", as well as optimism and means "persistently pursuing the goals despite obstacles and setbacks, as well as the compassion of" being able to recognize the feeling of people for success in one's life and profession" [14-15].

The more skilled he is at discerning the feelings behind others' references; He could have better controlled the signals he sent to them. A sympathetic person excels in guiding the service, i.e. anticipating, identifying and meeting clients' needs as well as the development of others by sensing what they need to progress and enhance their capacities, Taking advantage of diversity in the sense of seizing opportunities through diverse people and political consciousness, i.e. reading the group's emotional currents and power relationships, and understanding others by distinguishing emotions behind needs and desires and finally the existence of social skills of developing interpersonal skills that serve as success in an individual's professional life [8].

In the context of human resource management, it can be said that emotional intelligence plays a significant role in improving employee relations, enhancing effective leadership, and increasing engagement and performance [8, 11]. Emotional intelligence is of great importance for both employees and leaders for several reasons [14-16]:

1. **Developing social relationships:** The ability to understand the feelings and needs of others helps in building strong relationships within the organization. This can lead to improved interactions among employees and the promotion of collaboration and teamwork.
2. **Effective leadership:** Leaders who possess emotional intelligence can better understand and guide their employees. They can also motivate and support employees when needed.
3. **Stress control and tension management:** Employees with emotional intelligence can effectively cope with pressure and stress, which enhances their performance in the workplace.
4. **Developing negotiation and conflict resolution skills:** Emotional intelligence can help improve negotiation skills and conflict resolution, reducing the escalation of conflicts and contributing to a conducive atmosphere within the organization.
5. **Employee engagement:** Employees who feel understood and emotionally supported are more likely to commit to the organization and increase their productivity.
6. **Selection and recruitment:** In the context of human resource management, emotional intelligence assessments can be used as a criterion for selecting and hiring employees, as it can have a positive impact on employee performance.

Item Response Theory (IRT)

It is also known as the modern theory of measurement, also called Latent Trait Theory, because it is concerned with linking the examiner's response to a scale item with certain characteristics to his or her ability to answer that item [3, 17]. It also focuses on locating of an individual on psychological and educational scale, a set of mathematical and statistical models; be used to analyze item and benchmarks, and are intended to determine the relationship between an individual's performance in tests or measurements, and the characteristics or abilities he possesses, and thus to interpret his performance or predict his subsequent performance [12, 17], when each model or mathematical function focuses on a range of assumptions; The relationship between the examiner's observed performance on the scale and the underlying features [4].

The item response theory is one of psychometric theories, which has proved useful in overcoming some of the deficiencies suffered by classical test theory. The theory attempts to model the relationship between the level of a particular trait in an individual (Trait Level) measured by a given scale, its response to items scale, levels of unforeseen trait are estimated through foreseeable responses, usually assuming that the trait of responses is (Ability) is a characteristic of an individual, so that there is a regular relationship between different individuals' levels of ability and their likelihood of answering different test items correctly. However, in item response theory, the description of this

relationship has become based on Logistic Function [3].

The developer of the scale assumes the item response theory; are attributed to underlying features that number less than the number of items. In most applications of theory, one feature is assumed to explain responses to scale items, according to a mathematical model that shows how examiners respond with different levels and abilities. This method enables the researcher to compare the performance of examiners who progress different tests, as well as to apply the results of the analysis of the item to groups at different levels of ability than the group that analyzed the paragraphs through their data [18-20].

In addition, item response theory is based on a set of strong assumptions, which must be achieved in the data in order to produce reliable results, since the data must have a dimensionality assumption of the measured feature, as well as the realization of the presumption of localized autonomy of the test data. This theory emerges from a set of models called latent trait models, in which each model is expressed with a mathematical function that determines an individual's performance relationship on a paragraph of the scale with his or her ability to underlie and interpret this performance (Baker, 2001; Tashtoush et al., 2023 c).

Theoretical Assumptions of the IRT

Note that any mathematical model in the item response theory; It depends on a number of assumptions regarding the nature of the data being used according to the model used, so it is based on a number of strong assumptions, which should be achieved in the data being used to produce reliable results. These assumptions are clarified [4, 9-10]:

A. The Item Characteristic Curve: Models for responding to a one-dimensional item presuppose; the presence of a continuum of the attribute to be measured, and the likelihood of an individual responding correctly to a test item can be estimated. If we know his location on this connection. These models presuppose a mathematical function that connects the likelihood of a correct answer to an item and the ability of a group-measured examiner. This function has a specific advantage for each item, when each takes the form of a logistical curve called the "Item Characteristic Curve". This curve shows how the trait level changes in relation to changes in a given response's likelihood [3, 21].

B. Dimensions of Latent Space (Unidimensionality): Latent space means a set of dimensions unrelated to a bend. The dimensions of this space depend on the number of features of individuals in the test item space ", and can be multidimensional, as can be assumed to be Unidimensionality means that the test item is homogeneous and measures a single latent ability or trait. A Unidimensionality can also be assumed to have a single trait or ability that interprets the performance of screeners on the scale; In the sense that all the items of the scale measure one dimension, i.e. an individual's answer can be interpreted as belonging to this ability measured by the items of the scale, then the scale is referred to as Unidimensionality. Achieving this assumption requires a prevailing factor (dimension) that affects performance on the scale, and scientists have been unanimous in examining this assumption using the analysis, analyzing the examiners' responses and looking at the underlying Eigenvalues and the ratio of variance interpreted for the first factor. Unidimensionality is also referred to when there is a dominant factor, when the difference between the value of the Eigenvalues inherent in the first factor and other factors is relatively large. There are a range of standards to be made available to judge Unidimensionality verification by working analysis of the basic components of the protective using the Rasch model, namely: Raw variance explained by measures should be from (20% to 80%), the ratio interpreted by Factor II should be less than (5%), the Eigenvalues of the ratio interpreted by Factor II should be less than (3).

C. Local Independence: The probability of an individual's correct answer to an optional item is independent of the outcome of their answer to any other test item, when adjusting both the estimated value of their ability and the estimated value of the difficulty of the item. Therefore, localized independence indicates that the test's item may be unrelated. The presumption of positional independence also refers to the theoretical equivalent of a Unidimensionality presumption; the examiner's response to an item of the scale at any point on the theme is not affected by the response to the rest of the items. That is, there is no correlation between any two test items, nor does the assessment of individuals depend on the ability of any other group of individuals performing the test, or on the difficulties of the items they perform. That is, the responses of the examiners to the various items of the scale; statistically independent at a certain level of ability, this is inconsistent with one of the principles of classical measurement theory, which emphasizes the importance of internal consistency of tests [22-25].

Rasch Model

The Rasch model is one of the Unidimensionality item, the model is based on the binary level, it can be considered a model in which the Item Characteristic Curve is represented by a single-parameter logarithmic weighting function (One- Parameter Logistic Function), and the variable of the simple Rasch model is the probability that an individual (j) answers the correct answer. The independent underlying variables are the individual's ability (θ_j), the difficulty of

item (b_i), and the variables are modeled on a probable mathematical formula, the non-linear logarithmic weighting function (Nonlinear Logistic Function) as equation (1) [12]:

$$P_i(\theta) = \frac{e^{\theta_j - b_i}}{1+e^{\theta_j - b_i}} \quad (1)$$

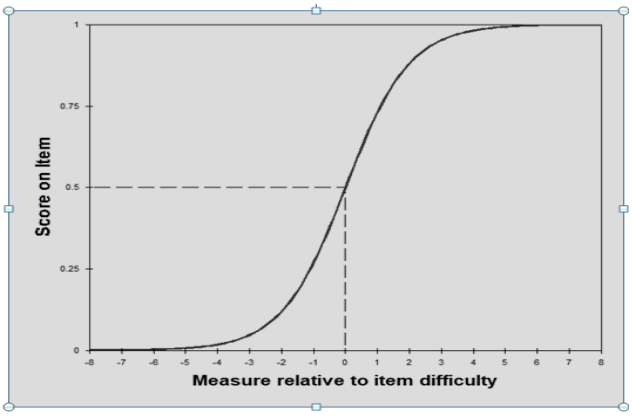

Fig. 1: Characteristic Curve of the mathematical formula

This formula is called a single-parameter logarithmic weighting model (1PL), because it uses an exponential function of probability prediction that includes only one parameter (milestone), which is the hallmark of the difficulty of the item (Item Difficulty Parameter) to represent the differences between the items, and the mathematical formula can be represented by the Item Characteristic Curve. As in figure no (1).

Choosing the Rasch model for analyzing the Emotional Intelligence scale is based on several logical foundations that make it suitable for assessing unidimensionality and local independence of items. The researchers have relied on several logical foundations that make the choice of the Rasch model an appropriate tool for assessing unidimensionality and local independence of items. These foundations include [12, 26-28]:

- **Statistical Equating:** The Rasch model is used to analyze standard data based on individual interactions with items in the scale, allowing for precise statistical equating of individual behaviors. This can be valuable in analyzing the various dimensions of emotional intelligence and how individuals interact with them.
- **Capability to Analyze Limited Data:** The Rasch model is primarily used to analyze limited standard data, making it suitable for assessing the few items in the Emotional Intelligence scale. This helps in analyzing the data more accurately and estimating the impact of each item individually.
- **Local Independence:** The Rasch model is appropriate for assessing local independence of items in the scale. This means that an individual's response to a specific item is not influenced by their responses to other questions in the scale. This is important to ensure that the items measure different and independent aspects of emotional intelligence rather than being highly interrelated.
- **Model-Based:** The Rasch model provides a model-based view of performance across individuals and items, aiding in the assessment of the appropriateness of items for the scale and their standard use.
- **Enhanced Estimation Accuracy:** The Rasch model can enhance the estimation accuracy for the level of emotional intelligence for each individual separately. This helps in obtaining precise assessments of individual performance without being affected by external variables.

Differential Item Functioning (DIF)

The Differential Item Functioning is an important part of the analysis of the items of the scale, as well as of the standards of sincerity of the internal structure of educational and psychological tests. The biased item measures the non-original characteristics in two different groups of individuals, but they are equal in the overall test mark. That is, differential performance is a necessary but insufficient condition for bias. The item showing differential performance was unbiased if the difference was attributable to the two groups' differing ability to respond to the item. Differential Item Functioning is also biased, when the performance difference is attributed to factors unrelated to the measured attribute [16].

In the past few decades, Differential Item Functioning of DIF has received greater attention in language test research, when used to identify sources of bias at the item level, and through the application of a DIF analysis, psychometrics and

pedagogics have verified that tests are fair and impartial to a particular group, thereby providing factors for misinterpretation of test scores; such as sexual or racial content, unequal prediction of performance standards, unfair content regarding test applicants' experience, inadequate selection procedures and inadequate standard measures [21, 29].

DIF occurs when people have the same level of ability, but belong to different groups, showing differing possibilities for answering an item, and there is another factor that affects a person's performance other than his or her skills, then the test is biased. On the other hand, if the Differential Item Functioning of two groups can be attributed to a real difference in their ability levels, then called effect rather than bias [30].

DIF analysis is used to ensure the fairness of tests and to ensure that they assess skills accurately without any bias towards any group of individuals. Some famous examples of items that may exhibit DIF based on gender include [31-32]:

- **Language exams:** There may be questions that contain words or concepts that may be preferred by one gender. For example, there could be words related to emotions and feelings that one gender responds to more favorably.
- **Leadership assessments:** Some questions may pertain to communication skills or social leadership, and these questions may exhibit more bias towards one gender at the expense of the other.
- **Mathematics and physics tests:** Sometimes, there may be questions related to mathematical or physical concepts that are preferred by one gender over the other. For instance, there could be questions about mathematics or physics that exhibit DIF based on gender.
- **Mechanical aptitude tests:** Some tests that assess mechanical abilities may exhibit DIF based on gender, where certain mechanical concepts may be better understood by one gender.

2 Methodologies

Participants

The participants of the present study (396) were selected from among the staff of the Sohar University in the Sultanate of Oman. The participants were randomly selected from the two gender groups (i.e., males and females). The female group included (177) persons of the total participants and the rest of (219) examinees were male.

Instruments

The Emotional Intelligence Scale consists of two dimensions: personal competence and social competence. The personal competence scale has a total of 75 items of which 33 items measure Emotional Self-Awareness, 9 items measure Restraint, 10 items measure Achievement Orientation, 12 items measure Positive vision, and 11 items measure Adaptability. The social competence scale has a total of 58 items of which 11 items measures Sympathy, 14 items measure Organizational awareness, 7 items measures Influence, 5 items measures Coaching and Mentoring, 5 items measures Conflict management, 7 items measures Teamwork and 8 items measures Inspiring Leadership. The items all are 5-point Likert scale format. The Winsteps software Version 3.72.1 was employed for the data analysis [25].

To verify the validity of the scale, the validity of the arbitrators was used, as the scale was displayed on (10) Arbitrators of academics and specialists in fields related to research variables who work in different universities and destinations in order to make their observations on the appropriateness and relevance of the items of the scale for achieving the study's objectives. Construction validity was also calculated by calculating the correlation between the average of each item and the total average of the dimension. For the personal competence, the correlation coefficients ranged between: (0.225- 0.540) for Emotional Self-Awareness, (0.489- 0.664) for Restraint, (0.573- 0.746) for Achievement Orientation, (0.582- 0.735) for Positive vision and (0.587- 0.680) for Adaptability. For the social competence, the correlation coefficients ranged between: (0.494- 0.718) for Sympathy, (0.571- 0.735) for Organizational awareness, (0.519- 0.809) for Influence, (0.558- 0.824) for Coaching and Mentoring, (0.917- 0.940) for Conflict management, (0.648- 0.807) for Teamwork and (0.585- 0.770) for Inspiring Leadership.

Scale reliability was also verified through the use of the Alpha Cronbach coefficient and the results indicated good reliability and internal consistency of the scale. For personal competence, the value of the Alpha Cronbach coefficient was: 0.841 for Emotional Self-Awareness, 0.792 for Restraint, 0.875 for Achievement Orientation, 0.875 for Positive vision and 0.845 for Adaptability. For the social competence, the value of the Alpha Cronbach coefficient was: 0.859 for Sympathy, 0.914 for Organizational awareness, 0.839 for Influence, 0.793 for Coaching and Mentoring, 0.961 for Conflict management, 0.869 for Teamwork and 0.854 for Inspiring Leadership.

Procedure

The Emotional Intelligence Scale is administered to the staff of the Sohar University in the Sultanate of Oman. The present study focused on one aspect of test validity which was assessed through the implementation of the Rasch model. To investigate DIF analysis and apply the Rasch model, the statistical and mathematical assumptions must be met.

Data Analysis

Like many IRT models, the Rasch model rests on two basic assumptions: unidimensionality and local independence. The unidimensionality assumption requires that there is only one underlying construct measured by the set of items included in the scale. That is, the scale measures only one factor. Unidimensionality was checked through Principal Component Analysis (PCA) in Winsteps. What is required is the fact that there must be one dominant factor explaining the shared line of covariance among the items. Hence, unidimensionality will hold if the first extracted factor explains a much higher amount of the total variance than that explained by the secondary dimensions. For determining the unidimensionality of scale in the PCA method, conventional criteria were used by suggested the following criteria for unidimensionality: a). if the amount of variance explained by measures be > 20%, b). "The unexplained variance of the eigenvalue for the first contrast (size) < 3.0 and unexplained variance explained by first contrast < 5% is good" [25]. The local independence assumption requires that an examinee's response to an item does not influence his or her response to any other item. Hence, the items must not give a clue to the correct response for another item [4, 33]. The data-model fit estimated through employing the in fit and outfit mean-square values to identify misfit and good-fit items. When it is said a person or an item may be mishitting, it denotes that an intended person and item does not act as the Rasch model would predict. The fit estimation checks for the model miss-specifications that can be evaluated in the fit between the model and the data. The normal range of acceptable fit is between 0.70 and 1.3.

3 Results and Discussions

The Unidimensionality assumption requires that there is only one underlying construct measurement by the set of items included in the Emotional Intelligence Scale. That is, each sub-dimension in personal competence and social competence measures only one factor. In the current research, the Unidimensionality of the sub-dimensions and its items were checked through a Principal Components Analysis (PCA) of residuals.

In order to assess dimensionality, PCA of the Rasch residuals was performed. Table (1) showed that the variance of the measurement dimension is 28.40% with 11.80% of raw variance explained by persons and 16.6% raw variance explained by items. The results showed that it is larger than the requirement of 20%, demonstrating a unidimensionaltrait of the data. The first unexplained variance accounted for eigenvalue is 3.4, which was good by referring to the criteria.

Table 1: PCA Analysis for the personal competence scale

Variance in Eigenvalue units	**Eigenvalue**	**Observed**
Total raw variance in observations	69.8	100%
Raw variance explained by measures	19.8	28.40%
Raw variance explained by persons	8.2	11.80%
Raw Variance explained by items	11.6	16.60%
Unexplned variance in 1st contrast	3.4	4.90%

Table (2) also showed statistical indicators to verify the Unidimensionality of each sub-dimension of the personal competence scale, which indicates that all sub-dimensions demonstrating a unidirectional trait of the data. The value of the variance explained by measures for the five sub-dimensions (Emotional Self-Awareness, Restraint, Achievement Orientation, Positive vision, Adaptability) equal (21.9%, 37.5%, 44.8%, 42.8% and 40.5%) respectively, which is between the ratios (20% - 80%). The unfit items in the dimension (emotional self-awareness) were deleted. The first unexplained variance accounted for eigenvalue ranged from (2-2.4), which was good by referring to the criteria (less than 3).

Table 2: PCA Analysis for sub-dimensions of the personal competence scale

Sub-dimension	**Emotional Self-Awareness**	**Restraint Orientation**	**Achievement**	**Positive Vision**	**Adaptability**
Number of items	17	9	10	12	11
Raw variance explained by measures	%27.7	%37.5	%44.8	%42.8	%40.5
Unexplained variance in 1st contrast	2.4	2.1	2.0	2.4	2.3

Local Independence

Although the unidimensionality assumption rewards a presumption of local independence but does not go beyond it. For example, the inclusion of the same math item twice in a mathematics test will not change its objective dimensions, yet the examiner is expected to either succeed or fail in both items together, so responses to identical items will not be locally independent. The results in table (3) indicate that local independence of the personal competence scale's items and sub-dimensions has been achieved through the values of the largest standardized residual correlations used to identify dependent items. The values of correlation coefficients ranged between (0- 0.51), which was good by referring to the criteria (less than 0.7).

Table 3: Local independence for sub-dimensions of the personal competence scale

Dimension	**largest standardized residual correlations used to identify dependent item**
The personal competence	(0.37,0.51)
Emotional Self-Awareness	(0.25,0.34)
Restraint	0
Achievement Orientation	0.26
Positive vision	(0.26,0.34)
Adaptability	(0.28,0.32)

For the social competence scale, table (4) showed that the variance of the measurement dimension is 37.7% with 20.20% of raw variance explained by persons and 17.5% raw variance explained by items. The results showed that it is larger than the requirement of 20%, demonstrating a unidirectional trait of the data. The first unexplained variance accounted for eigenvalue is 3.6, which was good by referring to the criteria.

Table 4: PCA Analysis for the social competence scale

Variance in Eigenvalue units	**Eigenvalue**	**Observed**
Total raw variance in observations	49.7	100.00%
Raw variance explained by measures	18.7	37.70%
Raw variance explained by persons	10	20.20%
Raw Variance explained by items	8.7	17.50%
Unexplned variance in 1st contrast	3.6	7.30%

Table (5) also showed statistical indicators to verify the unidimensionality of each sub-dimension of the social competence scale, which indicates that all sub-dimensions demonstrating a unidimensionaltrait of the data. The value of the variance explained by measures for the five sub-dimensions (Sympathy, Organizational awareness, Influence, Coaching and Mentoring, Conflict management, Teamwork, Inspiring Leadership) equal (39%, 47.10%, 49.30%, 53.6%, 83.5%, 54.3%, 51%) respectively, which is between the ratio (20% - 80%). The first unexplained variance accounted for eigenvalue ranged from (1.5- 2.4), which was good by referring to the criteria (less than 3).

Table 5: PCA Analysis for sub-dimension of the social competence scale

Sub-dimension	**Sympathy**	**Organizational Awareness**	**Influence**	**Coaching and Mentoring**	**Conflict management**	**Teamwork**	**Inspiring Leadership**
Number of items	12	14	7	5	5	7	8
Raw variance explained by measures	%39	%47.1	%49.3	%53.6	%83.5	%54.3	%51
Unexplained variance in 1st contrast	2.4	2	2	1.7	1.5	2	1.8

Local Independence

The results in table (6) indicate that local independence of the social competence scale's items and sub-dimensions has been achieved through the values of the largest standardized residual correlations used to identify dependent items. The values of correlation coefficients ranged between (0-0.48), which was good by referring to the criteria (less than 0.7).

Table 6: Local independence for sub-dimension of the social competence scale

Dimension	**largest standardized residual correlations used to identify dependent item**

The social competence	(0.31-0.40)
Sympathy	(0.25,0.27,0.48)
Organizational awareness	(0.21,0.22)
Influence	0
Coaching and Mentoring	0.04
Conflict management	0
Teamwork	0
Inspiring Leadership	0.22

Differential Item Functioning

The next step in data analysis was the DIF analysis. The ability and difficulty estimate in the Rasch model are assumed to be invariant. The statistical procedure (DIF) aims at identifying items with different statistical features across certain groups of examinees. In this study, DIF analysis was investigated for the gender groups and for the Emotional Intelligence Scale (the personal competence and the social competence) items. Table (7) showed the Classification of Differential Item Functioning size.

Table 7: Classification of DIF size

DIF	**DIF Size**
Small	Absolute value of DIF < 0.45
Medium	$0.64 \geq$ Absolute value of DIF ≥ 0.45
Large	Absolute value of DIF > 0.64

For DIF Analysis in a Rasch context, both magnitude of the difference in legit units between the groups and statistical significance of the difference should be considered. The DIF analysis between groups of male and female was investigated. The results of this analysis for the sub-dimensions of the personal competence scale are shown in Table 8. The results show that among 59 items, 9 items exhibit DIF and they are all small. Figures below represented the graphs of DIF analysis between groups of male and female for the sub-dimensions of the personal competence scale (Emotional Self-Awareness, Positive vision, Adaptability).

Table 8: DIF flagged items in the sub-dimensions of the personal competence scale

Dimension	**Item**	**Person Class**	**DIF Measure**	**Person Class**	**DIF Measure**	**DIF Contrast**	**Mantel Hanzl**		**Favors**
							Prob	**Size**	
Emotional Self-Awareness	A10	Female	0.5	Male	0.21	0.29	0.01	0.23	Female (small)
	A11	Female	0.64	Male	0.26	0.38	0	-0.02	Female (small)
	A20	Female	-0.09	Male	0.3	-0.38	0	-0.3	Male (small)
	A22	Female	-0.49	Male	-0.02	-0.47	0	-0.4	Male (small)
Positive Vision	D4	Female	0.05	Male	0.33	-0.28	0.01	-0.29	Male (small)
	D11	Female	0.08	Male	-0.44	0.53	0	0.24	Female (small)
Adaptability	E1	Female	-0.87	Male	-0.39	-0.48	0.01	-0.09	Male (small)
	E5	Female	0.58	Male	0.14	0.44	0.01	0.29	Female (small)
	E7	Female	0.42	Male	-0.08	0.5	0	0.39	Female (small)

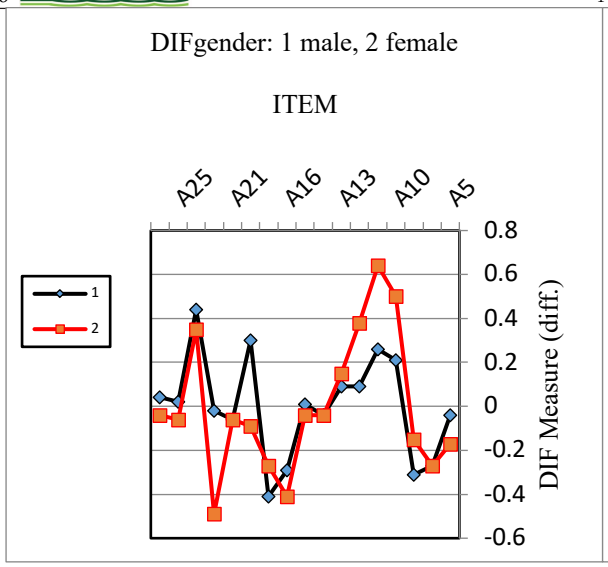

Fig. 2: Emotional Self-Awareness

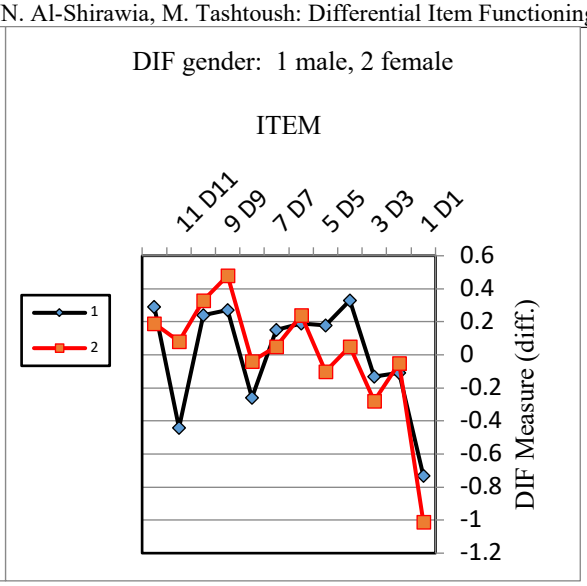

Fig. 3: Positive Vision

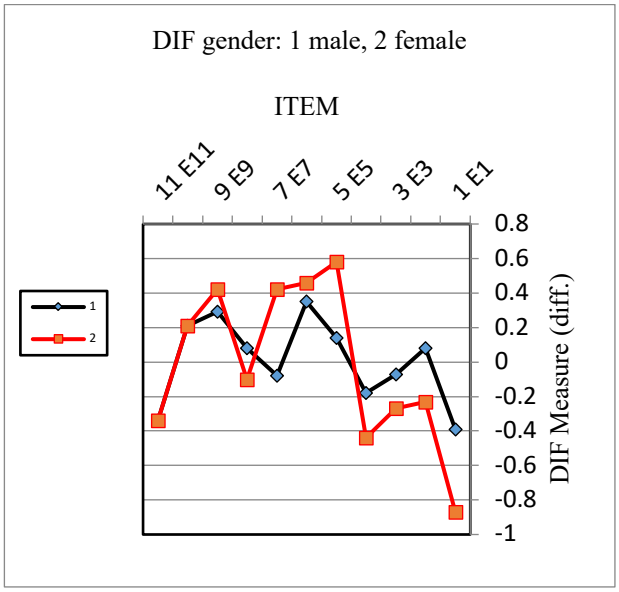

Fig. 4: Adaptability

The results of this analysis for the sub-dimensions of the personal competence scale are shown in Table 9. The results show that among 58 items, 11 items exhibit DIF and they are different in size (small, medium, large). Figures below represented the graphs of DIF analysis between groups of male and female for the sub-dimensions of the social competence scale (Sympathy, Organizational awareness, Influence, Coaching and Mentoring, Conflict management, Teamwork, Inspiring Leadership).

Table 9: DIF flagged items in the sub-dimensions of the social competence scale

Dimension	Item	Person Class	DIF Measure	Person Class	DIF Measure	DIF Contrast	Mantel Hanzl		Favors
							Prob	Size	
Sympathy	F6	Female	-0.17	Male	0.09	-0.26	0.04	-0.06	Male (small)
	F8	Female	0.21	Male	-0.04	0.26	0.02	0.34	Female (small)
Organizational Awareness	G13	Female	0.08	Male	-0.46	0.54	0	0.38	Female (small)
Influence	H3	Female	-0.18	Male	0.09	-0.27	0.04	-0.46	Male (medium)

Coaching and Mentoring	I3	Female	-0.01	Male	0.39	-0.4	0.02	-0.58	Male (medium)
	I5	Female	0.15	Male	-0.23	0.38	0.03	0.04	Female (small)
Conflict Management	J1	Female	-0.45	Male	0.39	-0.83	0	-1.05	Male (large)
Teamwork	K1	Female	-0.19	Male	0.21	-0.4	0.04	-0.22	Male (small)
	K6	Female	0.16	Male	-0.46	0.62	0	0.27	Female (small)
	K7	Female	0.24	Male	-0.25	0.49	0	0.4	Female (small)
Inspiring Leadership	L1	Female	-0.53	Male	-0.13	-0.39	0.03	-0.16	Male (small)

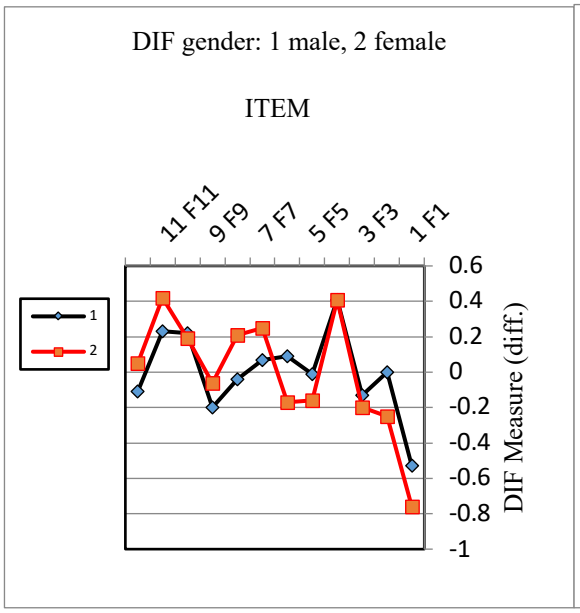

Fig. 5: Sympathy

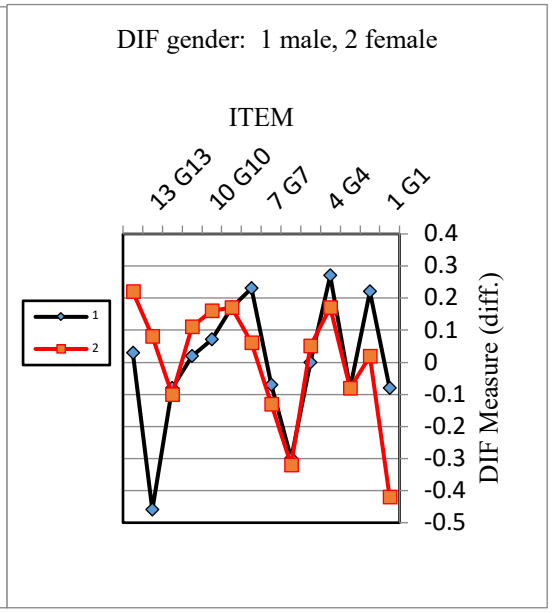

Fig. 6: Organizational Awareness

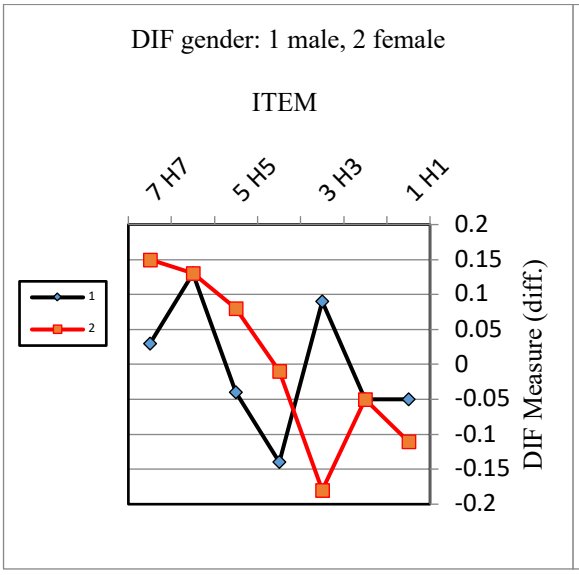

Fig. 7: Influence

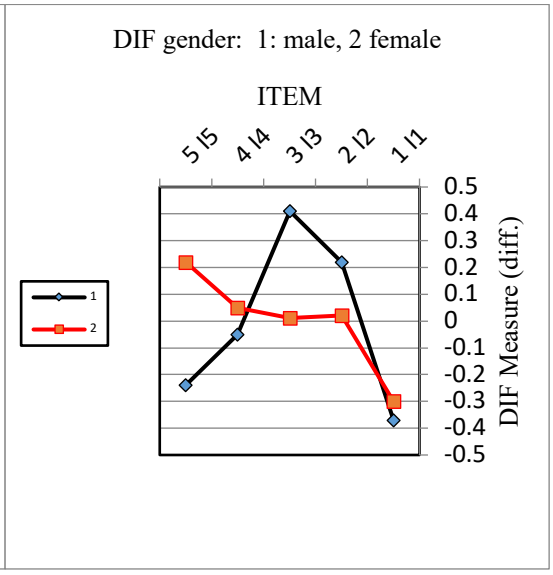

Fig. 8: Coaching and Mentoring

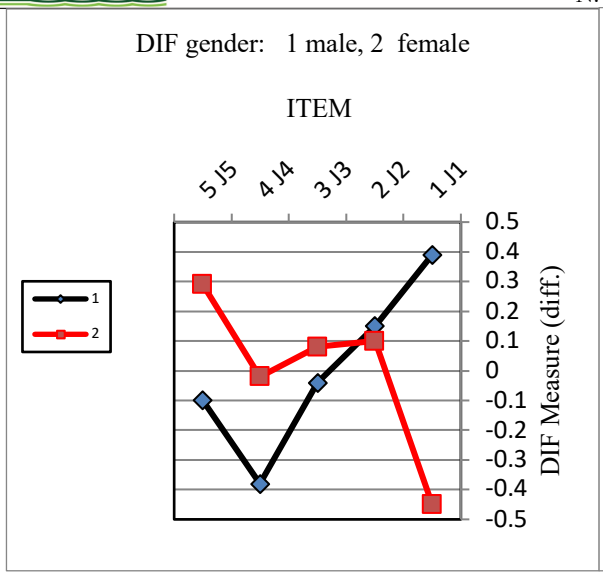

Fig. 9: Conflict management

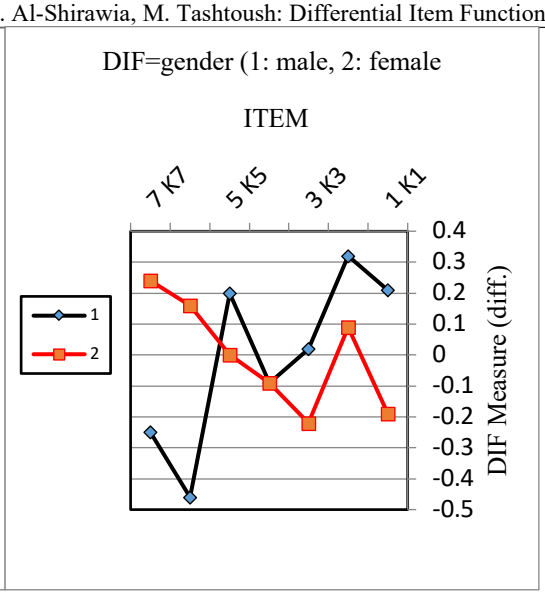

Fig. 10: Teamwork

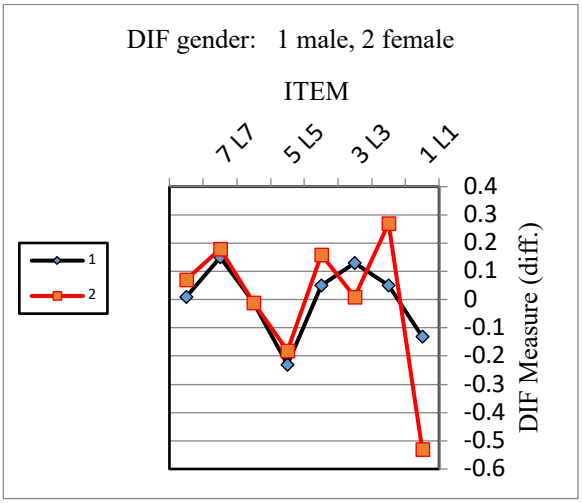

Fig. 11: Inspiring Leadership

B. Description: The scale consists of (33) items distributed to (5) domains. The items (1-6) represent the domain of sign in the system, the items (7-13) represent the domain of interaction with courses and learning using the system, the items (14-20) denote the domain of communication skills, the items (21-26) represent the domain of the skills of attending lectures, and the items (27-33) represent the domain of e-evaluation skills.

4 Conclusions

The present study aims at investigating the presence of DIF in terms of gender in an Emotional Intelligence Scale. In particular, results from the Rasch model and DIF analysis were compared to see whether evidence of differential functioning would be found in data analysis. The dimensionality was detected through the Principal Component Analysis (PCA) on the raw data and residuals. For the personal and social component scales, the amount of variance explained by the different components in the data was 28.4% and 37.7% (eigenvalue 19.8 and 18.7) respectively, which is larger than 20% as to be indicative of unidimensionality. The results of the data analysis suggested that the unidimensionality is held across the whole test. This result is consistent with study of [28], which means that the characteristic in the unidimensionality model can be assessed by matching each individual with the model, and that the common items in the unidimensionality parameter model is clear specifications and characteristics. In the case of local independence, the values of correlation coefficients were ranged between (0- 0.48) and ranged between (0- 0.48) for the personal and social component scales respectively, which it is concluded that the local independence assumption is strongly accepted in the entire Emotional Intelligence Scale.

This is what most previous studies have pointed out: that achieving a unidimensionality assumption rewards the hypothetical realization of local independence, such as studies [14, 27, 32-36] it should be noted that this study advised the deletion of the sub-dimension (conflict management) because it did not achieve a unidimensionality assumption, where the value of the raw variance explained by measures exceeded (80%).

The results of Rasch model's assumptions are based on the sample responses of Sohar University employees on the emotional intelligence scale of human resources management. It confirmed that the scale involves the structure of its unidimensionality trait. This was happening through well-construction of the scale and valid scientific methods, good application to the research sample, and verification of its results. This accurately reflects the measurement emotional intelligence of Sohar University's staff. DIF analysis confirmed a different probability of endorsing the scale items across the gender groups. Based on the DIF results, it is interpretable that out of the 59 items, 9 items displayed DIF-flagged items in the personal component scale. Furthermore, it is also interpretable that out of the 58 items, 11 items displayed DIF-flagged items in the social component scale.

For the personal competence scale; The results revealed a (small) bias to the emotional self-awareness in items 10, 11: (I feel my psychological issues are greater than anyone else.), (I face many problems as a result of my failure and disappointment), in favor of females, which means that females have a higher capacity than males in terms of feelings and sensations, which probably makes sense to the emotional nature of women.

The results also revealed a (small) bias in items 20, 22: (I panic when I encounter an angry person), (I like helping others in order to change myself.), in favor of males, this may be explained by the general panic and strange sense of insecurity caused by anger, especially if it relates to work and the associated renewal of labour contracts, which entail the life of families, the man is usually responsible for securing their resources and stability. It is also attributable to Arab-Islamic culture, which empowers men to communicate and help others more than women.

The results were also found in positive vision; a small (bias) in two items: (I can easily describe my feeling to my colleagues at work) in favor of males, this may be attributed to the nature of males and their level of audacity in describing their feelings compared to females, who feel ashamed and find it difficult to do so because of culture, customs, traditions and socialization. The second item was: "I avoid mistakes that I have already committed before". in favor of females, which means that females have a higher capacity than males to avoid mistakes, being more careful and fearful, which may be due to the nature of females, the quiet nature that is always cautious and fearful of repeating the same experiences and attitudes, while the process of male clarity and expression makes it easier for colleagues to describe feelings more easily compared to females.

The results have revealed in adaptability, a small (bias) in three items: (My sincere feelings help me succeed) in favor of males, and this result may be due to the nature of the community culture and associated customs and traditions that make men bolder and clearer in expression, to communicate what they want. While this is not the case when it comes to females, this is supported by the following two items: (I let my positive and negative emotions lead my life), and (I face barriers that prevent me from reaching my goals when I decide to accomplish any work) that came in favor of females.

For the social competence scale, The results found a small (bias) in sympathy in two items: (I can easily understand my colleagues' feelings) in favor of males: (I care about my colleagues' satisfaction with my work performance) in favor of females, which means that females have a higher capacity in terms of empathy in understanding feelings, and being careful to gain the satisfaction of co-workers compared to males, This is supported by some empirical studies of emotion [37-39], where it showed that female emotional abilities are greater than male, they have more emotional knowledge, express positive and negative feelings fluently and more frequently, have more personal competencies, and are more socially skilled.

The organizational awareness revealed a small (bias) in one item: (I am able to deal with work colleagues, listen to them, and understand their intentions) for the benefit of females, which may be attributed to the nature of socialization based on valuing etiquette and listening to others. An Influence revealed a medium (bias) in one item: (I deal with my work colleagues with a smiley face) in favor of males, which may be due to the socialization nature that gives males comfort in dealing with others compared with females who are afraid that their smile will be misunderstood [40].

The Coaching and Mentoring revealed small and medium (bias) in two items: (I allocate time to educate and train work colleagues) in favor of males and this may be attributed to the willingness of males at Sohar University to volunteer because of their time as compared to females assigned to family tasks as well as the professional burden of their male colleagues [41-42]. As for the other item (My way of dealing with my work colleagues encourages them to interact with each other) they have come in favor of females. This may be attributed to socialization, which is entrenched among females in the quest for interpersonal composition and cultivation of fraternity values.

The conflict management revealed a large (bias) in one item: (I have the ability to properly understand the causes of me and my colleagues' mood swings and act accordingly.) in favor of males. This may be explained by the breadth and

richness of males' experiences compared to females. The teamwork revealed a small (bias) in three items: item: (I raise work colleagues' motivation to achieve desired goals) in favor of males [43]. This may be due to the nature of male society, which allows males more possibilities for teamwork than females. The items: (I give personal attention to all my colleagues, each according to his/her own nature and private circumstances.) and (I deal with my colleagues as individuals and more than just members of a group) revealed a small (bias) in favor of females, and this may be interpreted as raising females that qualify them to give their co-workers more attention and affection as individuals than as co-workers.

The inspiring leadership revealed a small (bias) in one item: (I can offer unconventional solutions to some difficult issues at work) in favor of males, which is probably due to socialization in which education focuses more on qualifying males than females to take the initiative in solving difficult problems at work as opposed to females who overwhelm their emotional side compared to the practical one.

5 Recommendations

Based on the findings of this study, the researcher makes some recommendations: Through slightly higher than average abilities, in some sub-dimensions of the emotional intelligence scale, the study recommends the development of emotional intelligence in those sub-dimensions in the employees of Sohar University, the sub-dimensions are emotional self-awareness, restraint, positive vision, adaptability, empathy Organizational Awareness.

Through differential performance in the sample of the study in some items of the scale, the study recommends that attention be paid to the areas of emotional intelligence of the group that has a shortage, depending on gender, to avoid such differences.

The study's findings using the Rasch model underscore the importance of individual response theory in building and developing educational and psychological scales. The study therefore recommends that the results of this study be used to delve into other statistical indicators of the Rush model that have not been addressed.

Conflicts of Interest Statement

The authors declare that there is no conflict regarding the publication of this paper.

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