Geomatics Technology Education- Assessment of Learning Pedagogy

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Abstract

The paper investigates multidisciplinary education and specialization at the master's level, analyzes assessment methods, and proposes a technique for evaluating geospatial technology education. It emphasises is on pedagogical approaches, and highlights the importance of capacity building to meet the growing demand for skilled professionals in spatial information management. The research provides guidelines for improving course content, structure, and teaching methodologies, aiming to enhance the quality and relevance of geospatial education for both students and stakeholders. This paper is based on online data gathered from 115 universities across the globe, who are imparting geospatial education, campus-based and e-learning, also a survey was conducted of two thousand students. It supported in analysis and suggestion to develop a specific robust technique for assessment of the geospatial technology education and provides the corrective measures to the users of the technique. It proposed a framework aimed at enhancing the course content, organization, and teaching methods substantially. Further an attempt was made to adopt AHP model for investigating the statistical approach. It was aimed to know the actual values and significance of each parameter used for analysis of the study. In order to prepare a common guideline for improving the course structure, course content and teaching methodology, ANFIS architecture (Artificial Neural Fuzzy-Inference System) was adopted. Spatial information represented in the form of thematic maps in relation with the respective attribute data in Geographical Information System (GIS) environment is now used by all spectrum of the society, be it government organizations, industry, and academia. The result of the study has designed the criteria and common guidelines, which may be implemented, would able to help and curtail the challenges of the geospatial education as global vision for Local Action.

1. Introduction

Education plays an important role in building human capacity. It may not consist of tangible benefits, but it ensures lead to the personal development and career enhancements. Delivering education is of different types, recently during pandemic time of COVID-19, e-Learning became more popular. The other type is conventional, where the student teacher interaction is in classroom environment. The colleges and universities performs the education with adopting both the methods. The advancements in the technology know-how is demanding for the updating of the knowledge, where education system becomes the main instrument.

Geo-Informatics is one of the most advancing fields in scientific environment. It is used to create, manage, analyse the data and communicate the geographical information through Geo-visualization. It has an ability to conceptualize, develop, and operate systems for collecting and subsequently analysing spatial information about different variety of features. It is a force multiplier since it improves knowledge in numerous other subjects where geography is one of the components. (Vyas & König, 2016).

New paradigms for training and education are being created by the convergence of information technology advancements and societal shifts. Our training and education systems are greatly impacted by these significant changes. Education and training providers need to create effective and efficient learning systems to fulfill the demands of society in order to remain viable in this highly competitive global market. (Maitanmi et al., 2013).
In delivering the educational products the greatest advantage of the technology is taken that is through the internet, distance learning using digital technology. The evolution of information and communication technology has a broader effect on the learning environment as well. Interaction with digitally transmitted content, network-based services, and tutoring help are what produce the learning process. Topology may drive tremendous growth (Cappelli, 2003). The development in information and communication technology also have wider impact on learning environment, it is learning process created by interaction with digitally delivered content, network-based services and tutoring support (Markus, 2008).

Further, the potential offered by geospatial technology is promising, successful implementation requires a good understanding of how to integrate it into learning. Educators need to be trained to use GIS software and understand how to optimize this technology in presenting geography materials (Lee, 2023).

2. Purpose of the Study

Assessing the course is the most important factor for any educational programs to know its standards and maintain the quality of the course. Geo-Informatics is very much growing field from retail to institutional, recent advancements in the technology reflects increasing usage. Therefore, a study to identify the best and robust technique to enhance the course, learning & teaching is essential which can cater a need of skilled manpower.
Teaching Geo-Informatics. There are three main parts of the study those are: a) bringing out the benchmark from the universities survey: b) comparison of different performance assessment techniques of the educational program; c) survey and data collection from internet sources and questionnaire survey of large number of the students and derive guide lines for the significant improvement of the course content, structure, teaching methodology and developed a robust technique for assessment of geo-informatics education.

2.1 Education and Geo-Informatics

Geo-Informatics defines as science and art of measuring, storing, organizing, analyzing, visualizing data related to phenomena occurring on or near the earth's surface. It is the ever expanding technology from retail to institutional domain. Itis convergence of several field that is geography, earth science, computer science, information technology, planning, and mathematics. Geo-Informatics is characterized by emergent computer-based tools and techniques. The education of this advanced type of field is very much important in thistechnological era to solve the real time problems. Photogrammetry remote sensing and spatial information scienceplays very important role and useful to obtain reliable measurements of the terrain features with specific reference to their location and extent. Spatial information science studies the fundamental issues arising from remote sensing and

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geographic information as a well-defined class of information. It is the body of the knowledge that geographical information systems implement and exploit. Applications are varied and being extensively implemented in the field of Natural Resource management, Urban and Regional Planning, Infrastructure and Sustainable Development. It advocates ‘Global Vision for Local Action’.

It involves a strong and well defined intellectual core in the science of map making which is useful for decision making. As a global scientific field Geo- Informatics constituted at local, regional and national levels, represent ideas, ideologies and practices. Table reveals the subjects and application areas of Geo- Informatics respectively.

The field of technology is developing at an exponential rate, and the frontier of technical advancements is rapidly growing. With a multidisciplinary foundation, geo-informatics too is rapidly and diversified, with improvements coming from a variety of sources. Its multiplicative nature extends to the humanities, sciences, and technical fields even in the absence ofimmediate benefit. The enormous and multifaceted infrastructure of education and learning serves as the source of human capital that is so closely linked to the advancement of geo- informatics. Specialized knowledge of the subject is provided by plethora of courses offered through various universities and industrial institutions. Like many other fields, learning pedagogy is incorporating a variety of teaching and learning approaches through project-based, e-learning, and classroom-based approaches. Given the extensive current landscape of teaching and learning infrastructure, there is a continuous need for enhancements in pedagogical and evaluation methods. This study seeks to identify the necessary pedagogical advancements for future Geo-Informatics education. Hence it is aimed to benchmark the present practices, to propose best practices and standards for teaching Geo- Informatics. (Vyas & König, 2016).

3. Methodology

A comprehensive methodology of this has included three aspects, i) understand benchmark, ii) performance assessment and iii) derivation of the robust techniques. This is represented in the following figure 1.

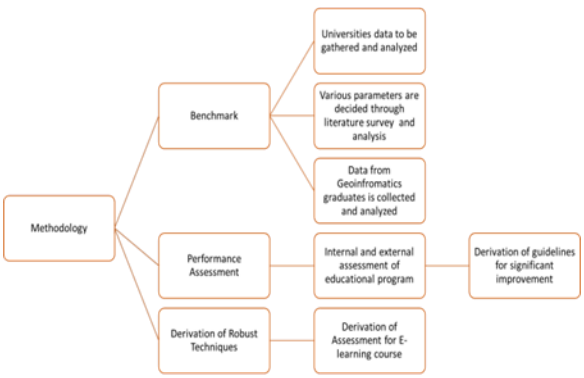

Figure 1. Methodology Chart

115 universities’ information have been gathered from on line through respective web portals and analyzed. Selected universities are shown in the Figure 2. The data downloaded were: i) at least two universities from each continent to keep the orthogonality, ii) detail of course content from these universities, iii) intake of the students from respective discipline and their job opportunity and placement, iv) Type of degree offered by the university, v) duration of course, vi) Methods used

4. Analysis and Results

Arbitrarily total 24 universities have been identified for the analysis on discipline-wise pattern of the intake in geo-informatics study and their successful graduation. It derives an understanding related to the idea of career building of the students that can be predicted. Figure 3 reveals the subject-wise enrolment in geo-informatics, their graduation and placement.

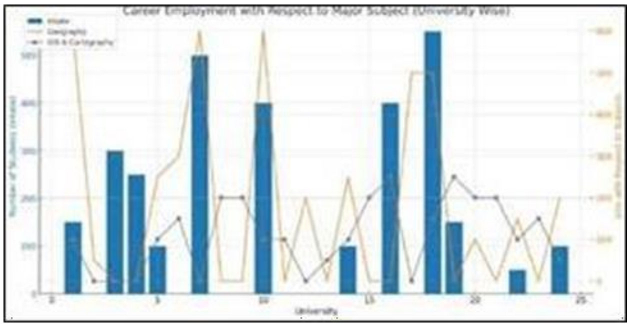

Figure 3. Subject-wise enrolment and Employment

The analysis is extended to a detail level where data is represented through a 3D model, representing universities and respective placement statistics. Further to this common courses across the universities have been analysed. This analysis revealsthe choice of the student opting for Geo-Informatics education. For instance, figure 3 reveals the courses of geography, surveying technology and environmental studies are more preferred to study Geo-Informatics. Students with backgrounds in geography, environmental studies, surveying, civil engineering, and geophysics are keen to pursue higher education in Geo-Informatics. This is followed by a graduation from oceanography, forestry, biology students opt for Geo- Informatics as master’s degree. Graph 4 reveals trend analysis of different subjects adopting Geo-informatics education.

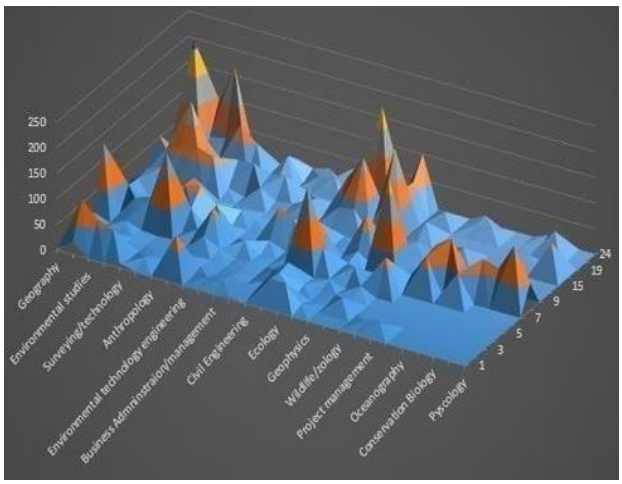

Figure 4. Trend Analysis of different Subjects enrolling for Geo-Informatics

Assessment of Learning Methodology: Assessment of any system can be done in two ways: external and internal. External assessment of a system is an assessment done by a (third party) neutral agency. This assessment primarily serves as a means of comparison and benchmarking across all systems delivering the same value proposition. In contrast, the internal assessment of the system is conducted through feedback and surveys. In this process, individuals involved in the system are asked to respond to a standard set of questions regarding the behavior and performance of the system. (Vyas.A. & König,G. (2016); ISPRS Archives XLI B6 45 2016, n.d.) Refer Table 1.

Internal Assessment Techniques	External Assessment Techniques
Rubrics Method	Centre for World University
Rating Scale	Qs Ranking Style
Checklist, Survey	AICTE and CII
Student Learning Outcome/Critical Thinking	Academic World Ranking Universities
Blended Thinking	Hong Kong Ranking Pattern

Table 1. Types of assessment techniques

4.1 Analytical Hierarchy Process (AHP)

Process (AHP) model to obtain the smooth weighting of every parameter. AHP, developed by Thomas L. Saaty, is a multi-criteria approach to decision making that makes use of both qualitative and quantitative evidence. Saaty examines the noteworthy characteristics of AHP as a ratio-scale measuring technique and provides the theory's axioms as well as some of its most important theoretical foundations. Saaty gives particular emphasis to the pairwise comparison matrix's (PCM) deviation from consistency, as this is required for the AHP's validity. Pairwise comparison matrices, or PCM, are used by the AHP method to make decisions. Extensive investigation has been conducted to assess the consistency of the (PCM). (Christos C. Frangos,et,al,WCE, 2014). All the parameters are taken into consideration, given parameter name as shown in Table 2 for calculating the geometric mean and getting the weightage statistical factor while an average is taken into consideration

The formation of matrix is being done i.e. t transposing the values obtained and matrix is formed, shown in the Table 2.

Parameter	Parameter	Average
1. Teaching methodology factor (includes different types of methodologies, examination, nature of learner)	A	73.5
2. Individual learner interest factor (includes learner attitude, physical ability, occupation)	B	73.5
3. Environmental factor (includes institutional or organizational environment, immediate learning environment)	D	69.2
4. Technological factor (includes hardware, software, mode of delivery)	E	70.7
5. Contextual factor (includes socio-economic, funding, cultural background, geographic location, language)	F	65.3
6. Planning Evaluation Factor (includes market demand, course objectives, quality assurance quality, target group students)	G	74.6
7. Development Evaluation Factor (includes assignment, examinations, learning resources)	H	71.2
8. Process Evaluation Factor (includes technical support, learning support, resource utilization)	I	72.3
9. Product Evaluation Factor (includes satisfaction degree, teaching effectiveness, learning effectiveness)	J	73

Table 2. Matrix Formation of Different Parameters

	A	B	C	D	E	F	G	H	I	Geometric mean
A	73.55	1	1	1.063	1.041	1.127	0.986	1.033	1.017	1.007
B	73.52	1	1	1.063	1.041	1.127	0.985	1.033	1.017	1.007
C	69.19	0.941	0.941	1	0.979	1.06	0.927	0.972	0.957	0.947
D	70.66	0.961	0.961	1.021	1	1.083	0.947	0.992	0.977	0.967
E	65.25	0.887	0.888	0.943	0.923	1	0.875	0.917	0.902	0.893
F	74.61	1.014	1.015	1.078	1.056	1.143	1	1.048	1.032	1.022
G	71.19	0.968	0.968	1.029	1.008	1.091	0.954	1	0.98	0.975
H	72.31	0.983	0.984	1.045	1.023	1.108	0.969	1.016	1	0.99
I	73.03	0.993	0.993	1.056	1.034	1.119	0.979	1.026	1.01	1

Table 3. Calculation of the values for each parameter

The geometric mean is calculated using the formula:

Geometric Mean = $\sqrt[n]{x_1 \cdot x_2 \cdot x_3 \ldots x_n}$

The weightage of each parameter is calculated using this formula:

Formula of weightage = $\frac{\text{Geometric mean of each parameter}}{\text{total geometric mean}}$

This how the weightage of each parameter is calculated and weightage of each parameter specifically obtained, which reveals the level of importance of each parameter.

Factors to be taken into consideration while designing the education system and which are vital for determining theranking of the online as well as offline education system are: i) Quality of faculty, ii) Publications, iii) Researches, iv) Citation,v) Influence, vi) Broad Impact, vii) Alumni Employment, viii) Quality of education, ix) Per capita performance, x) Student satisfaction and xi) Patent.

Generally, any course quality can be assured by performing series of evaluations. Various factors are taken into consideration for the preparation of the robust technique to evaluate different models like CIPP model (Context , Input, Process , Product); IPO model(Input, Process, Output); TVS mode and Kirkpatrik model. CIPP is the most frequently used model for evaluation in the field of social science (Zang, Jiang,2007). Referring to the CIPP model for evaluation of course, a system is proposed for the evaluation of course that consists of four major evaluation activities: Planning, Development, Process and Product. These are the four major parameters designed (Weiyun Zhang Y L Cheng, 2012) from the study of the other models.

In the model of PDPP, there are total four items as mentioned but as go deeper there are 26 different sub-parameters which are included under those four major parameters.

The first major parameter is planning evaluation. For e-learning, planning starts from studying the market demand of the course, then comes the target group of students. This depends on the skill and knowledge level required in their career. After this if the course offered is job oriented, then the employee's perspective is taken into consideration and then in the next step the financial assurance and the mechanism of the course is seen.

Development stage, the second parameter, of the course includes the analysis of the course objective, tutors, web utilization, availability of the resources, proper course development and blueprint of the course structure. Also during the development stage evaluation of eight activities of e- learning is corresponded. According to the research finding of (Zhang et al., 2006) evaluating the e-learning teaching process includes eight major parameters such as technical support, web utilization, learning resource, overall effectiveness etc.

Third, a Product evaluation determines the teaching effectiveness, overall outcome of the program and degree of satisfaction for both the parties i.e. the one who is imparting the education and the one who is receiving the education. And finally in the end of the whole model, the sustainability of the entire course is adjudged from the analysis made from the above mentioned factors. These parameters help in general to have a good quality assurance of the course.

All the above mentioned parameters have their own importance while designing course. These parameters take care of various factors such as course objective, the availability of the learning resources, the proper guidance of the students, proper formation of the course structure, blueprint of the course and adequate course material availability. Also the feasibility of the target group students and market demand analysis is taken into consideration. A continuous meticulous process is applied so that the course assessment is properly done keeping these parameters while designing the assessment method of the both types of learning systems for Geo-Informatics education. These parameters are very helpful and contain all the major things for designing any online course and help to assess that course.

A comprehensive framework is derived from the cluster to obtain the evaluation methodology for the course. There are 5 variables which individually play a major role. These are the parameters which are very useful while designing the online courses and at the same time it is helpful to derive the evaluating techniques. These are five parameters listed below:

1. Individual learner variable; 2. Pedagogical variable, 3. Technological variable, 4. Contextual variable and 5 Learner environmental variable. Each parameter has its own respective importance while designing the course curriculum.

This cluster for evaluation is very important and according to the course, the factors are disregarded and also eliminated as per the requirement. This cluster gives an idea for assessing the coursei.e. is it worthy to study or not. Considering the above mentioned factors, a better assessing system can be developed. This gives a clear vision for introducing the course.

4.2 Creation of Survey Questionnaire and Data Collection

Considering all the factors as important a survey questionnaire is prepared on the platform of google forms. Giving each criteria an equal weightage and survey data is collected focusing on how much each criteria get a score out of 100, two very simple questions are formed they are as follows: a) first to select whether respondent is a Student, Teacher, Academic Administrator or any other (to specify). b) Followed by the questions (rate each factor out of 100, each should be given percentage out of 100) on:

Enquiring the most important in designing ofa course? select from	Enquiring on most importantfactors while evaluating the program. Select from different variables:
i) Individual Learners Interest variable, ii) Learning Environments variable, iii) Contextual variable, iv) Pedagogical variable, v) Technological variable.	i) Planning Evaluation, ii) Developmt Evaluation, iii) Process Evaluation, iv) Product Evaluation

The two major questions are surveyed, on the basis of that the data is collected. The questionnaire is circulated to four colleges of India, two colleges of USA. Professors and academic staff from different countries are also requested to fill the survey form. Almost 1000 surveys are gathered consists of faculty member, students, professionals and experts represents Geo- Informatics domain.

To reach conclusions from the survey, various statistical measures, including mean, mode, and median, are calculated based on the collected data. The two major questions are surveyed, on the basis of that the data is collected. The questionnaire is circulated to four colleges of India, two colleges of USA. Professors and academic staff from different countries are also requested to fill the survey form. Almost 1000 surveys are gathered consists of faculty member, students, professionals and experts represents Geo- Informatics domain.

Designation/ Occupation	Teaching methodology	Individual learner interest	Environmental	Technological	Contextual	Planning Evaluation	Development Evaluation	Process Evaluation	Product Evaluation
Average	73.55	73.52	69.19	70.66	65.25	74.61	71.19	72.31	73.03
Standard Deviation	20.06	20.32	21.74	20.74	21.31	19.12	23.21	19.4	21.14
Mean	80	78	75	75	70	80	75	75	80
Mode	90	100	65	80	50	80	80	70	80
Variance	402.57	412.71	472.75	430.23	453.98	365.63	538.51	376.23	446.84
Median	55	27.5	62.5	35	52.5	57.5	55	10.375	5.375
% of Median	23.5	12	26	15	22.5	45.5	41.5	8.5	4.5

Table 4. Statistical analysis of each parameter identified

Nine factors are considered for analysis accordingly the techniques derived. It is observed that median value is very much progressive to use for derivation of the method because it gives the middle value of the data and shows equal probability of distribution of data. A value of average is used on the trial basis for deriving the method of assessment.

After calculating the value of each parameter as shown above, the questionnaire is further formed where the sub-parameters (variables) and making it easy for the end-user of the stakeholders. All the parameters are combined into the questionnaire formed. Each question of sub-parameter is with respect to that of the major parameter of the matrix. Similarly, the other questions too are prepared according to the other stages i.e. planning stage, development stage, process stage and product stage. The variables are Pedagogical, Contextual, Technological and Learning Environment. Percentage Median derived for various Evaluation Variable are given in bracket in the following table.

Planning Evaluation (45%)	Development Evaluation (40%)	Process Evaluatio n(10%)	Product Evaluat ion (5%)
Pedagogical Variable (55%)	Pedagogical Variable	Pedagogica lVariable	Pedagog ical Variabl e
Contextual Variable (52.5%)	Technological Variable	Learning Environmen t(62.5%)	Learning Environ ment
Technological Variable (35%)	Individual Learner (23.5%)	Technologic al Variable	Technolo gical Variable

Table 5. Sub- parameters matrix

This questionnaire helps in deciding the importance of all the factors to be considered while designing the course and gives a clear reason for the importance of each factor in the development of course.

Formulae is derived keeping all the parameters in observance. SCORE (100) =

$$\frac{1}{5}\sum_{i=1}^{12} ri * wi$$

ri = rank obtained from the survey

wi =weightage of each question

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Where ri= rank obtained from (0-5) for each question
Wi=weightage of each question
Considering the questions and calculating the weightages as per the formula following results revealed.

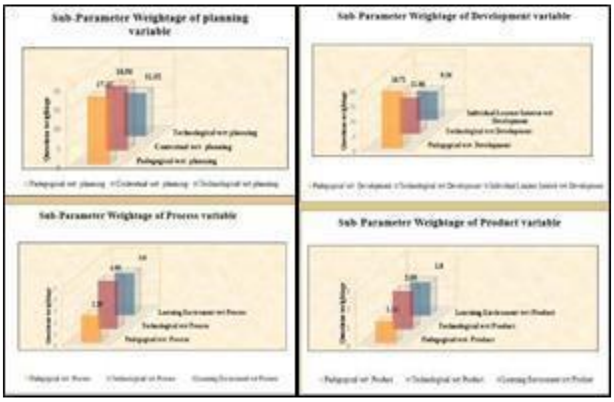

Figure 5. Specific weightage of Sub-Parameters w.r.t. Major Parameters

4.3 Derivation of Guidelines for improving the course structure

Universities conduct internal assessments regularly through feedback and surveys involving students, faculty, and management. The process for these assessments is straightforward. At the end of each academic session, universities carry out a series of surveys to gather student feedback on courses, curriculum development, and teaching methods. Students have the opportunity to rate the course content and provide an overall evaluation of their mentors. The collected feedback is then utilized for educational development, enabling appropriate adjustments to the course structure before the start of the new academic session. While statistical properties are derived from this feedback, the current evaluation process has not produced meaningful inferences. Implementing proper data analytics and inferencing could lead to significant improvements in course content, structure, and teaching methodologies. (Vyas.A. & König,G. 2016; ISPRS Archives XLI B6 45 2016, n.d.).

Frequently, preset questions are used to conduct surveys or gather feedback. Both closed and open-ended questions requiring a ranking response are included in the questionnaire. Upon completion of the set, respondents conduct an overall evaluation using a survey that includes common questions to identify commonalities. Undoubtedly, a pattern exists that dictates how the answers to a few questions impact the overall grade. To derive conclusions from the survey, statistical measures—such as mean, mode, and median—are calculated using the data collected from these surveys. A linear model is often fitted in order to investigate the behavior of people regarding the problem that the survey is conducted for. However, human behavior is very non- linear, making it difficult to fit a linear function or model. It is also debatable if such a linear model is accurate. Soft computing techniques are expected to be valuable in handling non-linear models. Fuzzy Inference Systems (FIS) are piecewise linear models that can interpret concepts expressed in natural language. Therefore, assuming a FIS model could produce better results than assuming a linear model. The survey data might be used to train an adaptive-FIS to identify the model with the pattern that shapes the overall rating based on the ratings of its component elements. (Vyas & König, 2016).

An Adaptive Neuro-Fuzzy Inference System (ANFIS) is a type of artificial neural network that integrates principles from fuzzy inference systems. (Kunal Thakur, 2024) It can potentially combine the advantages of neural networks and fuzzy logic into a single framework because it incorporates both of these concepts. A set of fuzzy correlates to its inference system.

Rules formulated in an IF-THEN structure that can adapt to approximate non-linear functions.

As a universal estimator, ANFIS can be utilized to identify the patterns that influence how ratings for specific questions affect the overall rating. As a result, the system's fuzzy membership algorithms will highlight the typical person's prejudice against each topic addressed in the feedback.

In Figure 6, the general structure and Figure 7 an interface of ANFIS are displayed. This demonstrates unequivocally that the system is both data-driven and rule-based at the same time. Basically, Fuzzy Inference Systems (FIS) consist of five main components: a decision-making unit that draws inferences from specific fuzzy rules, a rule base that contains these fuzzy rules, a database that defines the membership functions associated with the rules, and components for fuzzification and defuzzification processes. The first two subcomponents generally referred knowledge base and the last three are referred to as reasoning mechanism (which derives the output or conclusion). An adaptive network is a feed- forward multi-layer Artificial Neural Network (ANN), with; partially or completely, adaptive nodes in which the outputs are predicated on the parameters of the adaptive nodes and the adjustment of parameters due to error term is specified by the learning rules. Generally learning type in adaptive ANFIS is hybrid learning.

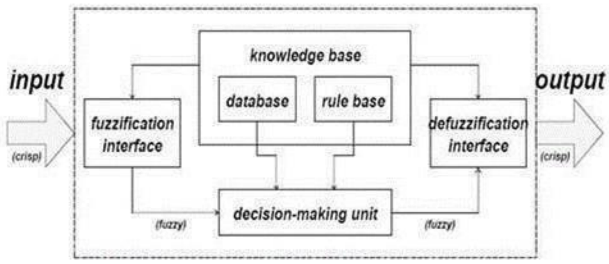

Figure 6. General Structure of ANFIS

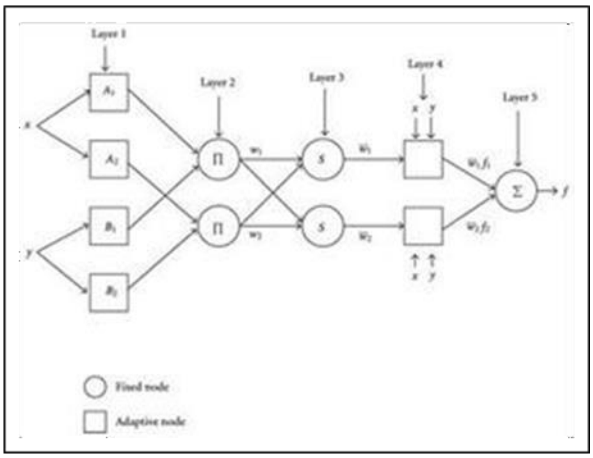

Figure 7. Interface of ANIFS

The fuzzification interface (Layer 1) includes fuzzy membership functions, which can be any continuous function defined for all possible input values. These functions effectively capture the answer's subjectivity. The rule basis that outlines how dependent questions are dependent on independent questions is contained in the knowledge base (Layer 2). For instance, the following rule might apply to a feedback system that only asks positive questions: The dependent question will receive a good rank on Layer 4 IF (Layer 1) every independent question receives a good rank. A final conclusion is reached after applying thefuzzy inputs to each rule's outputs and crunching the results.The anticipated rank for the dependent question is this ultimate determination. During training, the system adjusts the parameters of the membership functions and the weights assigned to each rule in the rule base by examining the difference between the expected rank of the dependent question and its actual rank from the database. By taking into account the ranks of the independent questions, the system can predict the rank of the dependent question. (Vyas & König, 2016). The complexity of this system is directly related to the number of rules, independent questions, membership functions associated with each question, and the shape of the chosen membership functions. As complexity increases, the size of the dataset required for training also rises. However, since ANFIS serves as a universal estimator capable of learning complex and higher-order non-linear functions, effective analysis can still be performed with a limited number of rules and straightforward membership functions. Nevertheless, having a substantial amount of training data is crucial for achieving optimal results.

Once the system is trained on a sufficiently large dataset, it can provide valuable insights. For instance, the discrepancy between the predicted rank and the submitted rank can indicate the authenticity of the feedback. Additionally, the degree of overlap among different membership functions for the same question can reveal the potential polarity of the responses. (ISPRS Archives XLI B6 45 2016, n.d.) This might then be utilized to assess the significance and applicability of the questionnaire's questions, resulting in the creation of an improved one. On the other hand, one may assess the bias present in each question relative to the final rating by looking at the form of these membership curves. This will support the development of the guidelines to improve the delivery of the subject. For instance, the following list of guidelines was created with the assistance of the trained ANFIS. Over 2,500 tuples made up the dataset used to train the ANFIS. The student were asked to rate each of the two sets of questions on the feedback form on a scale of 1 to 5, with 1 denoting very bad. Five questions regarding the course made up the first set, and 10 questions about the material delivery made up the second. It is evident that answering questions #1 through #4 immediately influences the answer to question #5, and answering questions #6 through #14 directly influences the response to question #15.

$$\mu_A(x) = \frac{1}{1 + \left|\frac{x - c_i}{a_i}\right|^{b_i}}$$

In this context, A represents the name of the fuzzy set, x denotes the input, and (\ a_i, b_i, c_i \) are constant parameters. During training, these parameters are adjusted to accurately reflect the relationship between the primitive questions and the conclusive question.

Using the membership curves generated from the trained ANFIS, an impact matrix was created. This matrix illustrates the effect of changes in ratings for one question on the overall ratings. Based on the scores assigned to each question, instructors can determine which questions respondents should focus on to enhance the overall ratings (specifically for questions 5 and 15). For example, if the ratings for questions 1 to 4 are 3, 2, 2, and 2 respectively, the instructor should prioritize the questions in the following descending order: Q.4, Q.2, Q.3, and Q.1. This approach aims to achieve a greater positive impact on the rating of Q.5 with minimal effort. (ISPRS Archives XLI B6 45 2016, n.d.)

Following matrix shows the impact (positive) on grade obtained in question 5 (On the whole, ‘I’ learned a lot from the course) with an improvement of grade in a particular question.

Questions	1→2	2→3	3→4	4→5
Goals of the course clearly specified	HI	LI	NI	HI
Well Designed and Structured	HI	LI	NI	HI
Reference Material Provided	NI	NI	HI	HI
Project-based Learning	NI	HI	NI	HI
Projects Usefulness	HI	NI	NI	HI
Instructor’s knowledge	HI	LI	NI	HI
Helped in sharpening knowledge	HI	NI	MI	HI
Communication Clarity	MI	MI	MI	AI
Encouragement	HI	MI	HI	HI
Timeliness	Ni	NI	HI	HI
Fair Assessment	HI	NI	NI	HI

Table 5. Interpretation of each Question derived from ANFIS Note: HI = High Impact; MI = Moderate Impact; AI = Average Impact; NI = No Impact

The method's suitability for any feedback system that includes a set of independent and dependent questions underscores its importance and relevance. All that is required are a few well-defined rules and a sizable quantity of data to facilitate learning. A deeper comprehension of human subjectivity is the method's result. (Vyas & König, 2016).

The weighting assigned to each item will aid in determining its significance and, ultimately, aid in the creation of a more effective questionnaire for next input. This method aids in: i) assessing the authenticity of submitted feedback by estimating responses to the dependent questions; ii) creating improved questionnaires by analyzing the bias or influence exerted by each rating on every question. If the impact of each rating on a question is consistent, it indicates that the question may be irrelevant.

Hence, it can be concluded that this method derived is very useful for at three stages. a) first at student’s level, the students can able to assess their learning level, b) second, the student’s assessment helps teachers to correcting themselves and increase their performance, c) lastly, the university would benefit from the positive actions of the students and teachers, also the university management understands on where does the course actually stands.The university can decide on the sustainability of the course offered with respect to, continue, upgrade or close down.

5. Conclusion

Geo-Informatics is an ever expanding field in today’s modern technological world. The ultimate expectation of the graduates and the professionals from this specific domain is increasing. Enrolment, graduation and placements of the university clearly indicate the directive of geo-informatics course.

Specific sectors like IT and computer science are much in the requiems of this domain starting from lower level that is from database management to the web based application, this technology plays a very dynamic role. The other areas, such as geography, earth sciences, pure science, planning, too are revealing impressive requirement.

This study contains a survey about the various teaching and assessment methods used by educational institutions across the globe. It elaborates over pedagogy used for teaching and training of Geo-Informatics.

Through benchmarking done with the use of extensive surveys and deeper level analysis, a guideline for programme development in context of Geo-Informatics has developed.

The study also showcases the perspective of importance of the major parameters reserved while planning any course curriculum and how the gap between the industry requirements is maintained.

It also majorly emphasis on back hand of how the ranking is given to universities and b what means any course is arbitrated, and what significance that criteria holds and in view of that which methodology should be adopted and put into the action.

An innovative mathematical technique has been obtained through surveys, and after that the major important parameters for the derivation have been decided. Finding the weightage of each of parameter, and then preparation of course is suitable. It also provides a provision for checking of course by using this method and can predict the success of the course.

A new analytical approach for internal assessments based on feedback is proposed for the introduction of new programs. This method facilitates recommendations for substantial enhancements in the system, encompassing course content, structure, and teaching methodologies.

Major analyses have been carried out from the study and results are derived are as follows:

Through the various survey analyses, the major outcome for the study that has been acknowledged is the importance of the Geo-Informatics education world-wide has been addressed. Influence of this subject in the different other fields of education is explained. Importance of GIS study regarding the placement of the student and its career in this field is majorly recognized.

Literature review has been carried out for making the important choice of the parameters used for the study.

The AHP model has been used on the pilot basis for scrutinizing the Statistical approach and to know the actual values and significance of each parameter used for analysis of the study

Additionally, application of statistical data has been carried out and a robust technique is derived for assessing the course and corrective measures are provided to the user of the course.

Derivation of general guidelines for improving the course structure, course content and teaching methodology has been studied with help of ANFIS architecture (Artificial Neural Fuzzy-Inference System). With that a system can derive robustness and sustainability of a multidisciplinary geo- informatics course offered.

6. Way Forward

Analysis on deriving the different parameters oriented models for the online education system can be studied.

More emphasis can be given on the upcoming Geo-Spatial Technology advancements and addressing to all stakeholders, than only the academia, can be added in the analysis as a future scope of the research.

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