



RESEARCH ARTICLE

Education Management Information System - Three-Tier Web Application Prototype for Education Workflow

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ABSTRACT

Agriculture education in India is unique with a flexible course credit system. The workflow behind this unique education system needs customized education management information software for educational planning and management with a reduced process time in education workflow. This paper put forth a prototype of the Education Management Information System (EMIS) developed for Forest College and Research Institute (FCRI), Tamil Nadu Agricultural University, Mettupalayam. Three-tier architecture is used for FCRI-EMIS to be an effective distributed client/server system. The development is carried out in an open-source development platform. FCRI-EMIS is developed with four modules namely: College Management Information System, Degree Management Information System, Syllabus Management Information System and Student Management Information System to access, generate a report and analyze the identified entities. The developed prototype is executed and found an effective tool for decision making towards education planning and management.

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Keywords: Agriculture education; Education workflow; Educational planning and management; Three-tier architecture; Decision making.

INTRODUCTION

Agricultural education in India develops human resource capabilities to meet the future challenges of the agricultural industry. The ever-increasing demand for food increases the complexity of empowering human resources (Tamboli *et al.*, 2013). Hence, the agricultural education system in India is dynamically updated to strengthen the agricultural education. Decision making and planning process plays a vital role in educational planning and management to strengthen the education system (Hollands and Escueta, 2020). The decision-making process is data driven (Husein, 2014). Education workflow data that are collected manually are recorded either in ledgers or in excel sheet by the staff, which are (i) prone to errors (ii) lack of security (iii) duplication of data (iv) data inconsistency (v) lack of backups and (vi) time consuming process (Kelly and Casey, 2015). Providing consistent data is required for making right decision making. The data pertained to education workflow has to be collected, organized, stored, analysed and made accessible to all the functionaries involved in the education system (Vijaya *et al.*, 2016). Education institutions aim to provide advantage for the students through the education planning and management by analyzing the data in hand. Education institutions need EMIS to propel the progress to align academic

processes and deliver better student experience (Balram, 2018). As per UNESCO (United Nations Educational, Scientific and Cultural Organization) Digital Library, EMIS is a system for organizing information base in a systematic way for the management of educational development (Tegegn, 2003). Prewritten EMIS software such as Open EMIS (Open Education Management Information System) launched by UNESCO are available either as paid or free software but again need to be customised by and for the educational institutes to meet specific requirement of the institute (Kurt, 2001). Education institutes having the constituent colleges spread across the state need web based EMIS to access the core elements of EMIS anywhere at any time. Hence, EMIS requires effective distributed client/server design (Duan and Zhang, 2007 & Dissanayake and Dias, 2017).

This work is carried out to develop the prototype of web based EMIS for Forest College and Research Institute (FCRI) of Tamil Nadu Agricultural University, Coimbatore with objectives:

- To develop a prototype of management information system that collects, stores, processes, analyses and disseminates FCRI education workflow information for educational planning and management

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- To develop centralized integrated repository of education management information and
- To reduce the process time in education workflow.

MATERIAL AND METHODS

The prototype developed to provide error free, consistent, non-redundant and updated data anywhere at any time; centralized integrated repository of education management information; to analyse and report demanded information by the decision makers and planners. Learning management System (LMS) is an application software to enhance the learning process. LMS facilitates the teachers to create and deliver eLearning content. The proposed development is not used to deliver course content for e-learning as Learning Management System (LMS) (Steve, 2017).

Pre-Design Phase

In the pre-design phase Software Requirement Specification (SRS) document is developed describing functional and non-functional requirements of the proposed prototype (Ashima and Gaurav, 2019). Forest College and Research Institute Education Management Information System is a Web App that can be accessed by any computer/mobile with internet access regardless of what operating system the end user device has. Software suitability is carried out to address the objectives and the following open source software are chosen, downloaded and installed with Model-View-Controller Architecture Pattern (Rinci et al., 2017):

- Front end: PHP (Robin, 2015)
- Back end: MySQL (Robin, 2015)
- Server: WAMP (Robin, 2015)
- Framework: CodeIgniter (Rohit and Yogeshchandra, 2018)
- Editor: Sublime Text Editor (Ken, 2013)
- Responsive cross browser rendering: Bootstrap Framework (Befekadu, 2017 & Priyanka, 2017)
- Architecture: 3-tier (Figure 1) (Dong et al., 2008)

Requirement Engineering

Requirement engineering for web app development is similar to the system analysis of Software Development Life Cycle (SDLC) (José and Nora, 2004). System analysis is carried out to identify and document the requirements for FCRIEMIS to support organizational activities (Steven and Glenn, 2005). Preliminary analysis revealed development of education management system is in need to have centralised education information repository and

to ensure information availability even if the course teacher or coordinator gets transferred. An extensive system study is carried out to identify the entities; add attributes for entities and give meaningful attribute names; identify the relationship between entities; and to acquire full knowledge of problems and errors (Orawit and Khanitthep, 2016)

Logical Design is carried out to list and figure out the relationship between entities. The identified entities and their attributes are:

ENTITY: COLLEGE

Attributes of College

College name, objective, vision, address, degree programmes offered, contact details: mailed, phone, mobile, and fax, list of departments etc.

ENTITY: DEPARTMENT

Attributes of Department

Department name, Head of the Department, vision, action plan of the department, courses offered by the department, total credit load of the department offered to UG, PG & Ph.D., List of the Faculties, UG coordinator, PG coordinator, research coordinator, research schemes: PIs, Co-PIs, funding agency, budget, duration, status, contact details etc.

ENTITY: DEGREE

Attributes of Degree

Name of the degree programmes offered for UG, PG and Ph.D., Pattern (Semester/Trimester) Number of students permitted to admit quota wise (ICAR, NRI, Industrial), Duration, Fees details for UG, PG and Ph.D. quota wise (ICAR, Industrial, NRI) , Penalty for late fee payment etc..

ENTITY: SYLLABUS

Attributes of Syllabus

Name of the syllabus for UG, PG, and Ph.D., period in which the syllabus offered, number of years offered, structure of the syllabus, Courses offered semester wise, Flaws in the syllabus, Feedback on the syllabus from administrators, staffs, experts and students, Experiential Learning, RAWI, Project, Tour, Optional courses, MOOC courses, Certification courses etc.

ENTITY: STAFF

Attributes of Staff

UPF/CPF number, Name of the staff, qualification, designation, gender, date of birth, photo, experience in years, specialization, courses handled, publications, awards, UG project guide, PG/Ph.D. guided, additional role, university sub projects, externally funded projects, venture

capital scheme, training/workshop/ conference organised and attended, extension activities involved, e-content developed, teaching aids used, practical manuals prepared, text books/ books published, question banks prepared, tour programme executed, experiential learning course offered, year coordinator, academic counsior, RAWE programme coordinated, warden/deputy warden, student club/symposium organised, participation in student related activities, education cell activities, contact details etc.

ENTITY: STUDENT

Attributes of Student

ID number, name, degree programme, year of admission, gender, parent/guardian name, address, community, physically challenged, mother tongue, any other languages known other than English, medium of school education, rural/urban, identification mark, admission quota, first graduate, percentage of marks scored in S.S.L.C. and HSc, courses studied in HSc, extracurricular activities, sports, awards received if any, e-mail ID, mobile number, parents' mobile number, day scholar/ Hostelite, mess bill payment, semester fee payment, Semester number, courses registered, courses not cleared, marks scored in individual subjects, reregistration details, course completion details, OGPA, grade in the each course, performance analysis, conduct details, etc.

Entity Relationship Diagram (ERD)

Entity Relationship Diagram (ERD) is a technique used to model the data from the field of system analysis (Malcolm and John, 2010). In this work ERD (Figure 2) is drawn to: define terms related to entity relationship modelling; provide a preview

of tables should connect, what fields are going to be on each table; describe entities, attributes, relationships; build databases quickly; act as blueprint for implementing data in application; gain a better understanding of the information to be contained in the database; communicate with the logical structure of the database to users and bring out primary keys and foreign keys.

Education management information system proposed is designed with the following modules:

- College Management Information System – is a centralised repository of information about the various departments, courses offered by the department, staff of the institute.
- Degree Management Information System – is an organised collection of information for accessing and reporting degree programmes offered
- Syllabus Management Information System – is providing a platform to analyse the syllabus along with the detailed information of the syllabus
- Student Management Information System – is a repository of individual students' information for custom reports demanded by the end users and analysing the student performance reports to support decision making

RESULTS AND DISCUSSION

Prototype of the education management system for the forest college and research institute is developed with the following components.

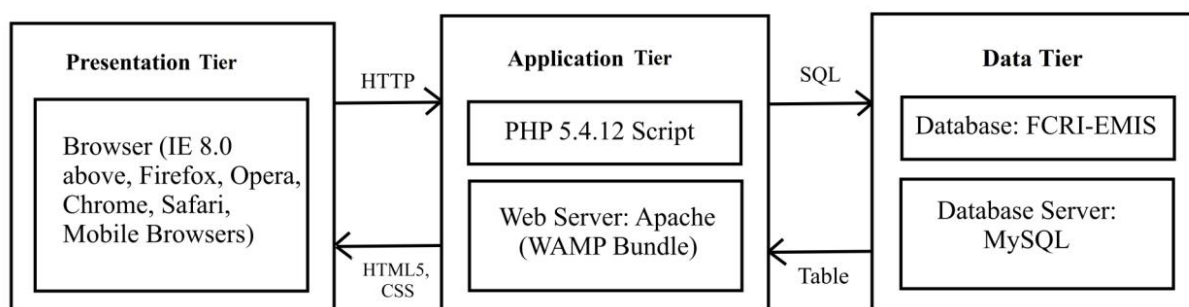


Figure 1. Three Tier Architecture underlying FCRI-EMIS

Opening Screen and Login Form

Opening screen of the system comprises of buttons to open up login form, sign up form, introduction about the system, links for college management information system, degree management information system, syllabus

management information system and student management information system (Figure 3 & Figure 4). The sign-up form allows the end users with email ID in TNAU domain for administrator and teachers and ID numbers for the students. Three different rolls are defined for the users as follows:

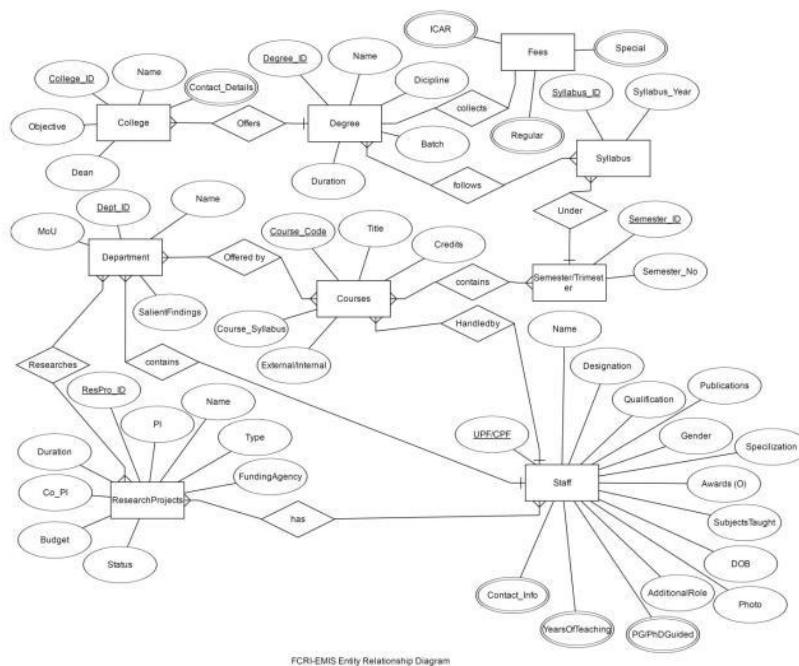


Figure 2. Entity Relationship Diagram

- Administrator roll is defined with all permissions.
- Teachers are the privileged users to update and submit the information.

- Students are permitted to view the required information.

College Management Information System

College management information system is a

Education Management Information System

[Log in](#)
[Sign up](#)

Forest College and Research Institute
Tamil Nadu Agricultural University

FCRI-EMIS

Forest College and Research Institute Education Management Information System collects, stores processes, analyzes and disseminates information for educational planning and management. FCRI-EMIS is a centralized integrated repository of education management information to reduce the process time in education work flow.

[Analyze](#)

College Management Information System

CMIS is a repository of colleges and research institutes of Tamil Nadu Agricultural University.

[More Info](#)

Degree Management Information System

DMIS on querying provides details of degree programmes offered by the institute.

[More Info](#)

Syllabus Management Information System

SyMIS is an intelligent system to extract and analyze to assist decision making process.

[More Info](#)

Student Management Information System

StuMIS is a transaction processing management system which provides demand based processed students' information.

[More Info](#)

Figure 3. Opening Screen

centralised repository of information about the various departments, courses offered by the departments and staffs of the individual College and

Research Institutes of Tamil Nadu Agricultural University (Figure 5 & Figure 6). User is allowed to choose the college and research institute from the

Enter the login details

X

UserName

Password:

Submit

Figure 4. Login Form

list box. Information such as college name, objective, vision, address, degree programmes offered,

contact details: mailid, phone, mobile, and fax, along with location are displayed.



Figure 5. Tile of Constituent Colleges of Tamil Nadu Agricultural University

Degree Management Information System

Degree Program Management Information System is an organised collection of information for accessing and reporting degree programmes offered

and lists names of the degree programmes offered for UG, PG and Ph.D. (Fig. 7). Upon choosing the degree programme introduction about the degree programme, starting year of degree programme, Pattern (Semester/Trimester), Number of students

Education Management Information System		Welcome Dr.M.Umadevi!	Log out
Modules	Home	College	Degree
	Syllabus	Student	
College Management Information System			
Silviculture			
Attributes	Values		
College Name	Forest College and Research Institute		
Objective	Improvement, Utilization and conservation of forest genetic Resources. Enhancing productivity of timber and non timber yielding species through precision silvicultural practices on an ecofriendly manner.		
Vision	To attain Global Excellence in Forestry Education & Research towards creation of professional man power to cater the needs of Production, processing and Conservation of forest Resources.		
College Address	The Dean (Forestry), Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam-641 301.		
Degree Offered	B.Sc.(Forestry), B.Sc.(Sericulture).		
College Contact	+91 4254 222010		
College Mail	deanformtp@tnau.ac.in		
College Mobile	+91 94890 56727		

Figure 6. Details of FC&RI, TNAU, Mettupalayam

admitted under regular, ICAR, NRI and Industrial quota, Duration, Fee details for UG, PG and Ph.D.,

Penalty for late fee payment, admission procedure, etc. are displayed (Figure 7).

Education Management Information System		Welcome sridevy.s!	Log out
Modules	Degree Management Information System		
Home	Undergraduate programmes	Postgraduate programmes	Doctoral programmes
College	B.Sc.(Forestry)	M.Sc.(Forestry)	Ph.D. in (Forestry)
Degree	B.Sc.(Sericulture)	M.Sc.(Sericulture)	Ph.D. in (Sericulture)
Syllabus			
Student			
© S.Sridevy, Assistant Professor(Computer Science), Dept. of Tree breeding, Forest College and Research Institute,Tamil Nadu Agricultural University,Mettupalayam.			

Figure 7. Degree Programmes Offered by FC&RI, TNAU, Mettupalayam

Syllabus Management Information System

Syllabus management information system is providing a platform to analyse the syllabus along with the detailed information of the syllabus and enlists the syllabus for UG, PG, and Ph.D., period in

which the syllabus offered, number of years offered, structure of the syllabus, Courses offered semester wise, Weaknesses in the syllabus, Feedbacks on the syllabus from administrators, staffs, experts and students etc. (Figures 8 & 9).

Student Management Information System

Student information system is repository ID number, name, degree programme, year of admission, gender, parent/guardian name, address, community, physically challenged, mother

tongue, any other languages known other than English, medium of school education, rural/urban, identification mark, admission quota, first graduate, percentage of marks scored in S.S.L.C. and H.Sc., courses studied in H.Sc, extracurricular activities,

Education Management Information System
Welcome sridevy.s!
Log out

Modules

Home
College
Degree
Syllabus
Student

Syllabus Management Information System

Undergraduate programmes

2007

2011

2015

Postgraduate programmes

2010

2014

Doctoral programmes

2010

2014

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Figure 8. Syllabi of Various Degree Programmes

sports, awards received if any, e-mail id, mobile number, parents' mobile number, day scholar/ hosteler, mess bill payment, semester fee payment,

semester number, courses registered, courses not cleared, marks scored in individual subjects, re-registration details, course completion details,

Education Management Information System
Welcome sridevy.s!
Log out

Modules

Home
College
Degree
Syllabus
Student

Summary of Courses

Attributes	Values
Total number of Courses	45
Total number of Credits	104 (61+43)
Total number of Core Courses	30 (42+27)
Total number of Supporting Courses	11 (14+12)
Total number of Courses in Odd Semester	28 (36+25)
Total number of Courses in Even Semester	17 (43+0)

Semester I

Course Code	Course Title	Course Credits	Department	Course Category
AGR 102	FUNDAMENTALS OF AGRICULTURAL METEOROLOGY	1+1	Agroforestry	Major Course

Figure 9. Summary of Courses

OGPA, grade in the each course, performance analysis, conduct details, etc. (Figure 10).

Testing

In the testing phase the errors were identified

and corrected. For example, mysql_fetch_array() error in the following code results a warning message shown in Figure 11.

```
$query = 'SELECT d.degree_name, d.established_year, c.colg_name FROM degree_master53 d,
```

107 | 7-9 | 328

SQL result

Host: localhost
Database: cmis
Generated Time: November 03, 2020 at 02:20 PM
Generated by: phpMyAdmin 4.0.4 / MySQL 5.6.12-log
SQL query: SELECT * FROM 'batch_master' LIMIT 0,12;
Rows: 12

batch_id	batch_name	degree_id	discipline_id	syllabus_id	start_date	end_date	no_students_admitted
1	2011	1	1	2	2011	2015	34
2	2012	1	1	2	2012	2016	49
3	2013	1	1	2	2013	2017	43
4	2014	1	1	2	2014	2018	38
5	2015	1	1	3	2015	2019	47
6	2016	1	1	3	2016	2020	53
7	2011	2	1	2	2011	2015	27
8	2012	2	1	2	2012	2016	29
9	2013	2	1	2	2013	2017	29
10	2014	2	1	2	2014	2018	24
11	2015	2	1	3	2015	2019	22
12	2016	2	1	3	2016	2020	27

Figure 10. Section of Query Result on Students' Strength Admitted

college_master c where c.colg_id = d.college_id and d.degree_id='.\$deg_id.';

Parameter name in the above code is corrected as given below to display attributes of degree (Figure 12).

\$query = 'SELECT d.degree_name, d.established_

year, c.colg_name FROM degree_master d, college_master c where c.colg_id = d.college_id and d.degree_id='.\$deg_id.';

Error occurred due to undefined variables as shown in Figure 13 are corrected to display the correct results (Figure 9).

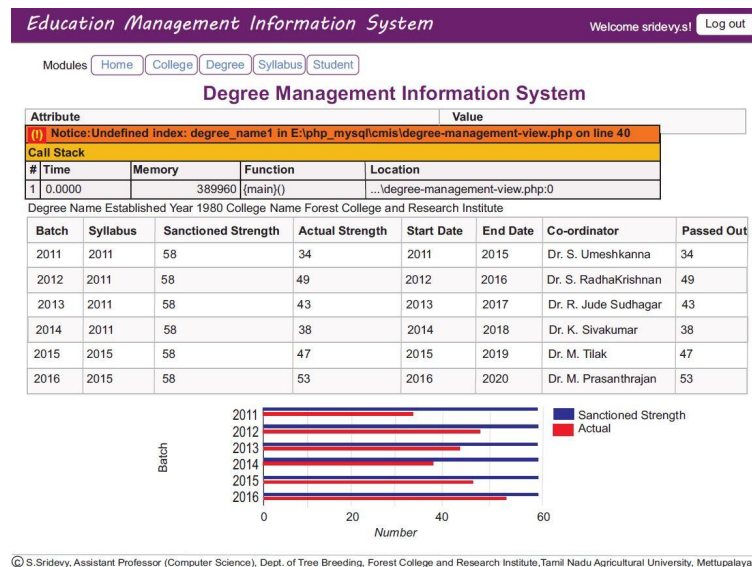


Figure 11. mysql_fetch_array() error

Data Generation and Impact Use

The study reveals the need for strengthening of EMIS at all levels especially at academic level by providing adequate resources in terms of human, financial and equipment and increase in

data coverage through legal and administrative mandates for the colleges. Other education data sources should be integrated with EMIS databases at all levels to complement and support annual academic data. There should be conformity and compatibility, through standards, in data capturing

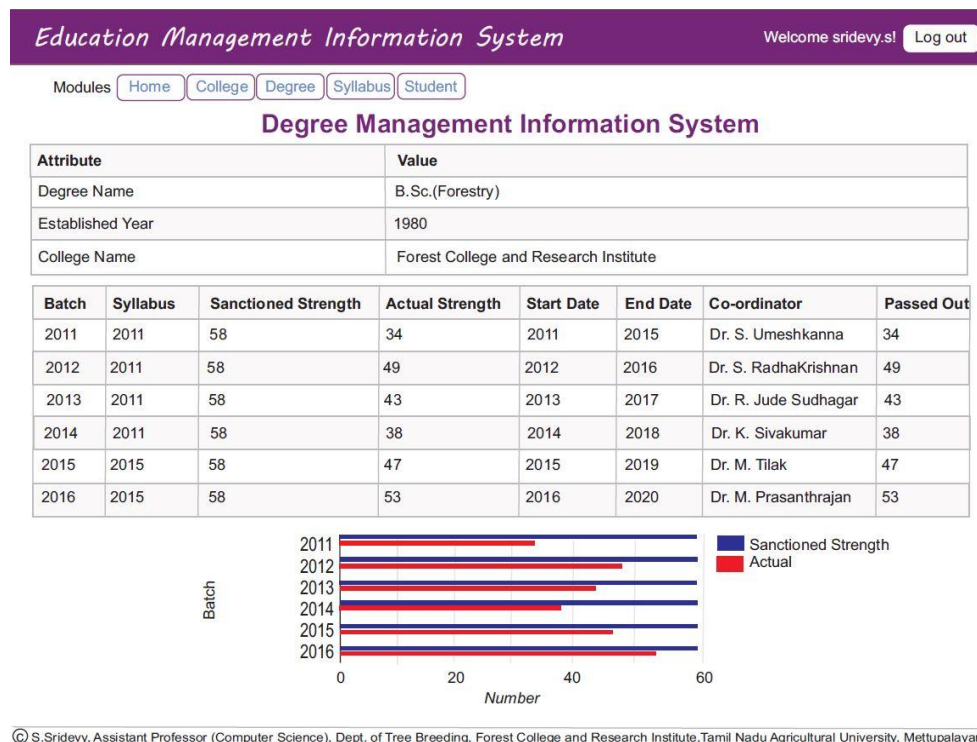


Figure 12. Result displayed after correcting mysql_fetch_array() error

and coding, database structure, data entry and storage software, and data verification procedures. EMIS should focus on collecting qualitative data about academic process and students' outcomes, as well as education finance data. The data reporting

format should be made user friendly and it should contain analytical text and education indicators. The EMIS should evolve reporting and information dissemination strategy to provide information to all stakeholders in a suitable format.

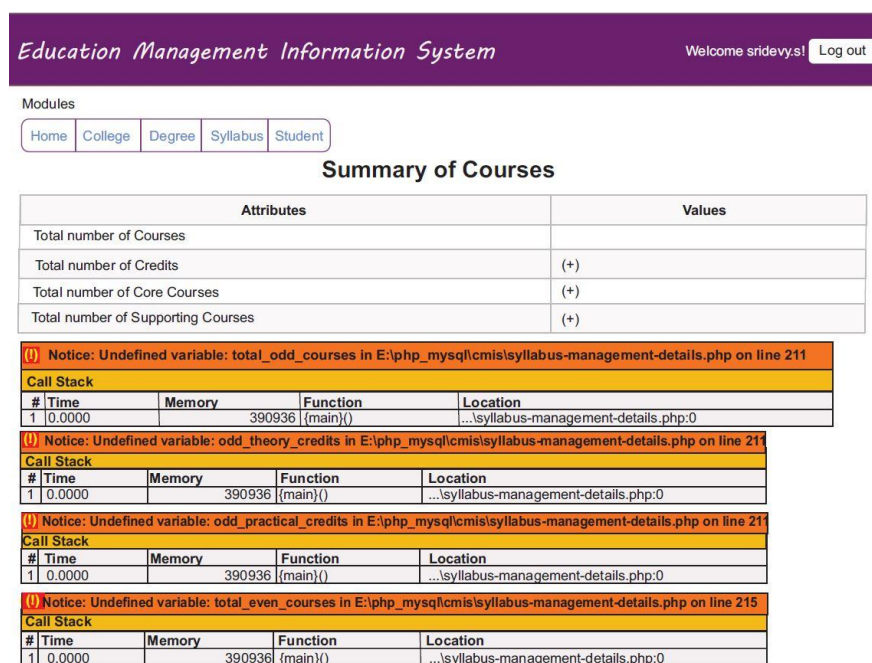


Figure 13. Undefined variable error

On the basis of data gap identified by decision makers at various levels, the provincial EMIS should collect data relating to annual examination results and students assessment, students drop-out, budget allocation and expenditure, college wise receipt of funds and utilization, additional facilities required in laboratory, students' attendance, capacity building needs of faculties, supervision by Dean, development schemes additional classrooms, and science laboratories, complete profile of teaching and non-teaching staff and number of students who need financial assistance.

CONCLUSION

EMIS data may be used at all administrative levels in various types of decisions such as situation analysis, target setting, budget preparation, formulation and appraisal of projects, textbooks purchase, construction of classrooms, starting of new programs, and provision of basic facilities. The majority of data users at all administrative levels were satisfied with the quality of EMIS data, however, level of satisfaction with quality of data varied across administrative levels. The data gaps identified by users included enrolment by age, failure, dropouts, students' performance, faculty performance and financial data.

In this paper, a prototype for education management information system has been developed. The developed prototype will serve as an alternative to the conventional system to manage the education workflow. The main intention of this prototype is to develop software which provides assistance in decision making for educational planning and manage it more effectively. EMIS ensures persistent data availability, integrity and confidentiality which plays a vital role in enhancing the quality of education system of an organization. This system allows Academic leadership to easily identify gaps and track the installation, usage and maintenance of all college facilities and infrastructure in the institute.

In short, EMIS is an excellent example of how IT has transformed the management of education despite many difficulties to success.

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