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Enhancing Usage of Scientific Formulae for Students less Proficient inEnglish language in an Undergraduate Class :a case study in Saudi Arabia

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Abstract:
The curriculum at General Sciences department in a Saudi Arabian University includes ‘’Physical science’’for Computer Science, Information Technology and Business courses. Students are apathetic towards Physical Science and question, as to,” How this course is related to their majors?” More than sixty percent of the students come from institutions where English is not the medium of instruction, which makes student learning and academic achievement challenging as they are less proficient in English language. After observing the uasge of incorrect scientific formulas in assessment test and the number of failures,for two consecutive semesters, the instructor was keen to find an effective strategy to enable students understand concepts and to transformed surface learning to deep learning through developing advanced techniques in writing assignment. The main purpose of this research is to roll the situation and let the students partake in the process of trasformation from diffident failures to confident achievers.This study is participatory action research, in which instructor designs effective written task to engage students in their learning . The study is conducted through two semesters with a total of 32 students. The effectiveness of this approach is studied using questionnaire at the end of each semester,students evaluation and teacher observation.Major outcomes of this study were overall improvement in students uasge of scientific formulas in tests,problem solving,language proficiency, performance in summative assessment and also fortifying confidence. This process transformed instructor into engaging and reflecting practitioner.Also, these strategy was implemented by other instructors teaching the course and proved effective in opening a path to changes in related areas of the course curriculum. However, refinement in the strategies could be done based on student evaluation and instructors observation.

Keywords:language proficiency,physical science education,scientific formulae,writing assignments

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Introduction

In conceptual physical science course students with diverse educational backgrounds are taught physical sciences.It focuses on the basics of physics and chemistry. Through this course students acquire a systematic body of scientific information to apply to new and challenging situations in a wide range of domestic, industrial and environmental contexts.Almost every topic is based on formulae in physics part which constituets 60 percent of this course and in chemistry, majority of the topics are based on periodic table.The tests questions can be answered by understanding and application of formulae and periodic table.Nevertheless, physical science instruction at undergraduate level in Saudi Arabia is challenging as all subjects are taught in Arabic language in secondary school level.

University students coming from diverse academic institutions where,English is not the medium of instruction, find challenges in understanding the terminology and grasping the concepts, when the course is taught in English. Large number of students are in this Physical Science course which does not include lab sessions.This course is a prerequisite, General Course and the students always question as to why they need to do this course,when their major is computer science,information technology and so on?The student cohort is apathetic towards this course except a small percentage.

It is a problematic issue as the course includes basic concepts of physical sciences and provides a good oppurtunity for students to score well. But the final grades of majority of the students show their underperformance.The students who are proficient in English language are at an advantage in understanding the concepts and answering the tests questions.English language proficiency and other aspects effect the students academic achievements.

The main purpose of this research is to roll the situation and let the students partake in the process of trasformation from diffident failures to confident achievers.In the process of finding a solution to the students learning disability and identifying the areas in assessment methods , in order to develop proactive strategies to improve performance in summative assessment,an advanced written assignment about scientific formulas taught was generated, in order to train students to transform surface learning to deep learning. The other objectives engendered during the journey were:to review and modify grading policy, to promote student learning not just memorizing,to help laconic students coomunicate,understand scientific concepts,answer questions by enhancing the usage of formulas and improve summative grades,to make the language barrier a glass barrier,to create active and more effective office hours, encourage interaction between instructor and students to develop language proficiency and to promote timely and constructive feedback and to improve course learning outcomes.

This research is the deft approach of a teacher to prepare to teach the given learners effectively, to improve students performance and confidence in summative assessment and find effective strategies to summarize the enormous syllabus taught in a semester in a nutshell inorder to overcome language barrier.

Literature review:

Physical science course

In science, a formula is a concise way of expressing information symbolically, as in a mathematical formula or a chemical formula..A physical science course has many scientific formulae.To help improve students performance in assesment and fortify confidence, enhancement in understanding the formulae and applying them appropraiately is very much needed.The main findings which guided this study about a teachers role in designining material to transform students from diffident failures to confident achievers is from (Colleae & Peoria, 1970) work which emphasized that, Students who enroll in this course usually take it only because they must, in order to fulfill a science requirement, and their attitudes toward science generally lie somewhere between indifference and repugnance.The maioritv of our Phvsical Science students are " very weak in mathematics. They could not help but fare badly in an ordinary chemistry or physics course. Interest lagged and class attention was poor.For this reason general principles are emphasized.

(Brent & Felder, 1992) one of the suggestions for using a variety of writing assignments is to write articles about assignments that work particularly well so that other teachers can get the benefit of your experience.

This fourteen teaching week course everything cannot be taught.As stated by (Freud & Cheronis, 1938), Students do not themselves perform experiments, their knowledge, gained from viewing demonstrations, hearing lectures, and studying books, cannot be sufficiently vivid to be permanent.This leads to the unexpected conclusion that further training in physical science is effective in preventing a student from changing.The authors also highlight the time constrain as reflected from “Also, an attempt, usually unconscious, to teach the four sciences individually often results in the inclusion of much detail which cannot be adequately tied together by theory and practice in the limited time allotted. The subject matter which is best retained consists of principles, theories, their applications, and related facts. That which shows the poorest retention is that which is memorized without the exercise of reason. Frequently, also, the only criterion of a student's success or failure in the survey course is a comprehensive examination, a condition which, in the eyes of many people, must encourage "cramming" at the expense of systematic day-by-day study, and "cramming" is believed to be almost valueless as a means of acquiring permanent knowledge.” “The teaching of a beginning course in science should be the development of understanding through the knitting together of principles,theories, and facts into one coherent whole, indicating threads leading away into the unknown but not following them.”

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Additionally,as details of derivation of scientific formulae are not taught in this course,Gangemi highlights this as “Our emphasis, however, is on the qualitative features of the basic laws rather than the quantitative.Class presentations, home work, and term paper assignments were chosen with the stated objectives specifically in mind”.(Gangemi, n.d.)

On the other hand, the suggestion of a heuristic not related to the goal very often resulted in superfluous syntheses, that is, a combination of facts into new wholes that did not further the

desired solution.Shulman (1970) suggests that a carefully planned program of research is necessary if answers to questions about problem solving are to be found. Very little research has been undertaken in the analysis of processes involved in problem solving and virtually none in the development of these processes, though the need for such research has been recognized. Further the work of (Kantowski, 1977) states that "It was observed that in many cases regular patterns of analysis and synthesis followed the introduction of a goal-oriented heuristic.Further the author highlights that experimental studies should be done to support this observation across ability levels and content areas.

Posner, Kenneth, Hewson, & Gertzog, (1982) have focused on the importance of accommodation as a radical change in a person's conceptual system.. Students are unlikely to have at the outset a clear or well-developed grasp of any given theory and what it entails about the world. For them, accommodation may be a process of taking an initial step toward a new conception by accepting some of its claims and then gradually modifying other ideas, as they more fully realize the meaning and implication of these new commitments. According to them the student must make judgments on the basis of available evidence.Further their research also asserts that the basic question concerns how students' conceptions change under the impact of new ideas and new evidence.

Writing

According to (Brent & Felder, 1992) students adopt deep approach to learning through writing.Writing assignments that call for creativity will elicit it from many students; repeated assignments of this type coupled with constructive feedback will improve the creative skills of all students. Further they cite Donald Graves (in Fulwiler 1987a) who asserts, "Writing is the basic stuff of education. It has been sorely neglected in our schools..We need to let them write.''(p. 1)

(Chi, Bassok, Lewis, Reimann, & Glaser, 1989)work focused on the importance of students converting the words from text into usable skills as,We find that "Good" students learn with understanding: They generate many explanations which refine and expand the conditions for the action parts of the example solutions, and relate these actions to principles in the text. These self-explanations are guided by accurate monitoring of their own understanding and misunderstanding. Such learning results in example-independent knowledge and in a better understanding of the principles presented in the text.

The investigation of (Tynjälä, 1998) about writing as a central tool of learning states,that their findings support earlier studies of writing-to-learn, suggesting that activating textbook reading by means of writing tasks and group discussions may enhance learning of the kind that higher education is aiming at: understanding, conceptional change and the development of critical thinking.

Action Research

Educational research owes much to Lewis (1946) and collier(1945(Newton & Burgess, 2008).The purpose of an ''action research'' is to identify the problem, collect data,reflect on , analyse it and

apply the new knowledge to enhance student learning.(Tripp, 2005) Researchers usually repeat the process as additional problems are raised and planning is done for additional improvements,revision and next steps.In our classes we have a variety of writing tasks that vary considerably in scope, objectives, and required level of instructor involvement but have in common a grounding in(Brent & Felder, 1992)

Significance of the study

The problem

After teaching the physical science course for two semesters, the instructor noticed that many students are scoring well in the quizzes and majors but the grades of most of the students on the final exam, which includes whole syllabus, are not as expected. The enigma of low scores and failure was solved by srutinizing the quiz,major and final exam papers and comparing the students performance.The papers of students who failed, showed how students vacillate in answering, due to lack of understanding and usage of formulae in physics and low proficiency in English language.The author realized that an immediate action has to be taken to enhance usage of Scientific formulae by students less proficient in English language, so that they participate better and the author was then fervid to design an 'Action Research' to address and seek a solution for laudable students performance and mollify them.

The aspects of the practice investigated

Thus, research and exploration to review and find student centered strategies, to improve scientific reasonig skills and cognitive academic language skills leading to improvement in the summative assessment was necessary and thus an 'Action Research' was meticulously planned and executed.(Shirani Bidabadi, Nasr Isfahani, Rouhollahi, & Khalili, 2016)

The aims were: 1) developing advanced techniques in Writing assignments to improve usage of scientific formulae and English language proficiency.2) transform surface learning to deep learning.3) provide greater opportunities to students for more participation and encourage interaction and communication with the instructor(Weaver & Qi, 2005).4) to create active and more effective office hours. 5). to measure student learning progress. 6.) to promote timely and constructive feedback 7.) review and modify grading policy and 8.) to achieve course learning outcomes.

The making of writing assignments as part of summative assessments transforms surface learning to deep learning process(Marton & Säljö, 1976). It helps students to develop cross connections between the topics and solve critical thinking questions.It also helps instructor/students to identify and fill learning gaps present due to diverse backgrounds and English languge challenges.Data collected through Summative assessments of this kind can help instructors to collaborate and redesign parts of the course and also improve from traditional teaching methods to creative methods from year to year.

Context and institutional setting

Brief details of the course

The course is taught in English to students who are in the process of learning English and focuses on the basics of physics (sixty percent) and chemistry(forty percent).Students take this General Sciences course only for one semester.Sixty percent of their assessment is comprised of three quizzes, two majors, group activities, homework and class participation,while the final exam is forty percent.Around 200 students take the course with the instructor every semester.The class time consists of three hours per week.This conceptual course covers many topics,requires prerequisite math and is not supported by lab sessions. Time constrains and the nature of this course leads to a less enthusiastic student cohort and the final grades of many students are not as expected as shown in table1.

Table 1. Contributio of the final exam marks in the overall grade

S.NO	/60(formative)	/40	/100 (summative)	Grade
1	38.3	22.5	60.75	D
2	38.2	21.4	59.6	D
3	48.3	31.7	80	B
4	46.9	34.1	80.95	B
5	35.6	20.1	55.7	F
6	49.6	33.2	82.8	B
7	54.5	34.3	88.8	B
8	39.8	31.3	71.05	C
9	56.7	39	95.65	A+
10	38	26.7	64.65	D
11	47.8	32.1	79.85	B
12	38.3	21.6	59.85	D
13	37.2	19.1	56.3	F
14	55.8	33.8	89.55	A

Source :the author

Brief details of the students' cohort

The concerned classes consisted of four sections with twenty five to twenty eight female studentsin each section. When the course started and within a couple of weeks, the author was able to see rough hierarchy in the students and a division of labor emerged and students could be classified into three groups based on their performances.About twenty seven per cent of the students were the ardorous students who were participating in class and had learning skills and were profecient in English.The other fifty percent represented the average students less proficient in English and remaining students were irregular to class,apathetic and English proficiency needed a lot of improvement.The main cause of students under performance in final exam discovered was lack of understanding and reasoning behind the scientific formulae and their application due to lack of cognitive academic language skills.(Johnstone &Selepeng, 2001)

Reflections on the practice

A careful scrutiny of the students performance for two semesters showed that many of them do not understand and analyse the test questions, the root cause is that the medium of instruction

is English and the students have low English languge proficiency.This is vividly reflected by usage of 1.)wrong formula in answers.2.) not being able to translate the formula into a statement.3.)doing wrong mathematical operations to solve the set equations and 4.)not being able to divide solution into steps and 5.)writing wrong units in the answer. The marks are scored for correct usage of formula and substitution , solving and value of answer with appropriate units.Some questions are answered by translating the formulas based on their Englisg language skills apart from reasoning skills. Hence they loose marks from the above mistakes. Final exam constitutes all the chapters covered throughout the semester. The quizzes and majors performance is good for many of them as they do not have many chapters. Even though formulae are included but not as many as in the finals.The mode of learning of many students is adopted to memorization, as English language is a challenge.Each semester the formative assesment marks of students out of 60 are good but for 50-60% of them when they take the final exam their grades drop and their results are not as expected from what is reflected out of 60 formative assessment marks. Performance was maintained by fifteen to twenty percent of them their but rest of the students performance is far from what is expected and seven to ten percent of them get F.Some times twelve to fifteen percent fail.

The question paper has questions which are mainly based on formulae and even theoretical questions can be answered by understanding with in the frame work of formulae and translating them.It is a problematic issue as the course includes basic concepts of physical sciences and there is good chance for the students to score well and increase GPA.Therefore, the above issue needed to be resolved and addressed to empower the maladroit students,which the author did.The author empirically addressed this issue and was to design a research model for this purpose.

Plan for intervention

The instructor was vehement in seeking a solution to the above issue.Therefore planning for an action research was done in one of the semesters.The instructor designed "A Practical Mode Action Research' to develop advanced techniques in Writing assignments and hence facilitate student learning and fortify academic achievement in an 'Action Research'(Newton & Burgess, 2008).This mode was used as it always has place for improvement and offers oppurtunity for continual reflection. An assignment which was designed and introduced as part of formative assessment was announced in the beginning of the semester. Instuctors action research was ardent modification in assignments to suit students learning style and empower learning of low English language proficiency students coming from diverse back grounds and creating familiarity with the course contents especially understanding and usage of scientific formulas and building their cognitive academic language skills.And also engage the instructor in conscious participation during this learning process.

The assignment was that after a chapter was taught students would write

1. All the formulae of that chapter clearly in word form and also in the form of designations with correct spellings.
2. The standard units of each quantity involved in an equation near that quantity.
3. Key words which help them to use a particular formula for a particular question.

4. After the end of each chapter they show this sheet and ones they are used to writing it, reminders are given to them to complete formulas of each chapter taught.
5. Students are welcomed in the office hours to discuss any aspect related to the assignment to develop cognitive academic language proficiency.(Menu, 2008)

All formulas which are taught in the course are on completion in this assignment and submision in the 10th teaching week. This ensemble of formulae is to be hand written and not typed. The mode of submission is to come in person during office hours, and not to send through friends or leave on the door and no soft copies accepted. The assignment sheet is marked in front of the students and mistakes are highlighted and brought to their notice.As Torres and Zeidler highlight, viva is conducted to creat an oppurtunity to communicate in English language and also to develop scientific reasoning skills.(Torres & Zeidler, 2002)
Improving the understanding and usage of scientific formulas for students who were less proficient in English language,was the primary focus of the instructor in the 'Action Research'. The process was meant to
a.)Improve students acquiring of concepts, scientific reasoning skills and language proficiency in order to select correct formulae to solve numerical problems and answer the questions.
b.) Closely supervise all students progress in the subject learned.
c.) Improve volatile Summative assessment grades.
It was also authors journey from experienced teacher to expert teacher.

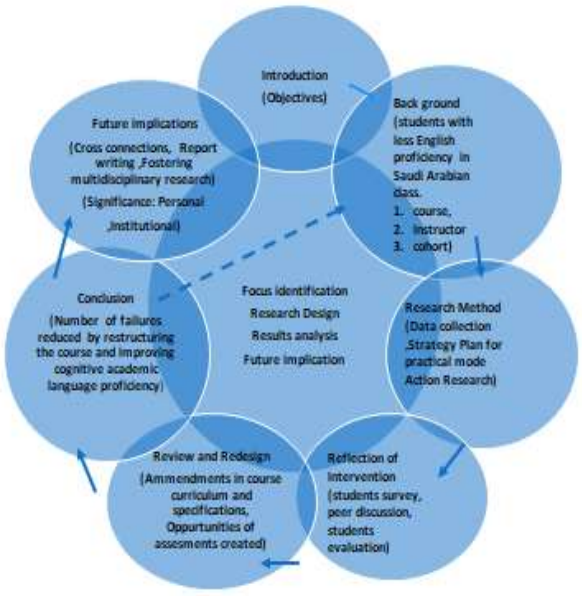


Figure.1. The framework of research

Methods

The author adapted mixed method approach in this research.Research participants were undergraduate students and the instructor from a private university in Riyadh.The adopted approach combines observation, description quantitative and qualitative research methods in assessing the case study. When used along with quantitative methods, qualitative research can help us to interpret and better understand the complex reality of a given situation and the implications of quantitative data(Collector & Module, 2011).Writing assignments can train students to seek connections between new material and previous and can transform surface learning to deep learning.(Marton & Säljö, 1976)

After analyzing previous semesters students results, where the students summative assessment performance was not as expected as from their formative assessment,and having discovered that the disadvantage in achieving better grades is the English languge challenge, one of the semesters the instructor designed and introduced an assignment which was announced in the beginning of the semester.This assignment would enhance the usage and application of scientific formulas and help understand scientific concepts.This was mentioned in the 'Course Syllabus' (that complements the 'Course Specification Document), which the instructor has handed and explained to all students at the beginning of the semester.

The assignment was that, after a chapter is taught to the students,students will write all the formulae of that chapter clearly in the form of words and also in the form of designations, as stated by (Brent & Felder, 1992) clearly relate the assignments to the course content, and be sure students understand the connections. And the other guidelines were stated following, (Brooks & Brooks, 1999) examples of teaching and learning interactions from the point of view of the teacher and the setting for the purpose of illustrating how the 'people in charge' might begin to restructure the learning oppurtunities they make available in their settings.

(Lemke, 1990) focuses on reconstruction of relation between items using language as , We know that scientific concepts are interlinked in their meanings, and that it is the use of systems of linked concepts that gives scientific reasoning its power.

The author designed the research method to answer the following question:What can the instructor do in order to enhance usage of scientific formulas and improve language skills and hence improve summative assessment performance?

a) To engage students in a task to improve understanding of scientific formulae and concepts through improvement in proficiency in English language.
b) To enhance learning methods of the students to help them acquire skills to solve the problems correctly and reach at the correct answers.
c) To engage in and closely supervise students progress in learning the topics taught and improve summative grades.

Data collection

Analyzing and data collection of previous students results of quizzes,majors and final exam, where the students summative assessment performance was not as expected as from their formative assessment and also the number of failures in the final exam,was a part of research. Action research was then planned and executed in the following semester.The quiz,major and final exam marks of the students who were given the assignment was analysed as next part of data.At the end of the semester after students submitted the assignment,the instructor designed and conducted a students' questionnaire,which was filled by students.The questionnaire which was also part of data had the title–"writing the given assignment is facilitating learning",the choices included were-if the students strongly agree, agree,strongly disagree,disagree and not decided.Also students end of semester evaluation of the instructor and teachers observation was incorporated in the data.

Implementing the action plan

Many of the students took this assignment earnestly and did chapter one formulas and got it checked in the office hour,to ensure they are on the right track for the rest of the chapters. For some of them it was extra work. Seriousness was not shown by 50-60 percent of the students in the beginning of the semester but they became serious just before the deadline. So the instructor started to grade it out of five. That really motivated most of them to submit completed assignment with in the deadline.

When they brought the assignment, 20-30 percent of them knew what they were doing,in fact their performance was very impressive and clear information about each formula was given in the form of tables,with correct spellings of terminology and so on indicating few pedant students too as shown in figure 3 a,b.

For the rest,insouciance of them many gaps in their understanding of scientific formulae and reasoning and languge efficiency were discovered.Like they didn't write proper standard units and proper spellings of terms for example acceleration was "axelracion". This further indicated very low cognitive academic languge efficiency.Some of them copied from others so had the same sequence and mistakes in spelling words and in form. They wrote only short forms, so they vacillate about what each designation stands for?Some formulas written could not be used to solve numerical problems and in quizzes they used it and couldn't solve questions using them,as in Figure 4.They wrote few formulas of a chapter and left the rest.Some wrote the formulae which were not taught to them and so on.

The instructor accentuated the areas of assignment which weakend or tempered the assignment and commented on what was missing, asked them to delete the stuff not taken during the course and took students viva and graded overall assignment out of 5.According to the study of (Grove & Wasserman, 2006) students of different academic aptitudes benefited differently from graded assignments, and also that their estimates indicate that first-year students in the experimental group performed 4.58 points higher on exams.

(Brent & Felder, 1992) made an important suggestion to ask students to evaluate particular assignments and the writing experience as a whole. The questionnaire to corroborate the usefulness of the assignment was distributed to 32 female students (one section) both national and international and 28 of them answered and returned it.The teacher also closely monitored and compared the grades,motivation and confidence of the students.

Data analysis and findings

The author analyzed and interpreted the collected data using Codes and Themes to organize style of interpretation After conducting the students' questionnaire as part of qualitative research. One of the important aspect of (Zucker, 2009)was that case study method can be a creative alternative to tradition approaches to description (quantitative descriptive and descriptive correlational descriptive designs) emphasizing the participant's perspective as central to the process.Rigour is built into this process by focusing the strategies used to generate meaning from the qualitative data.

Later, the final exam results and the students evaluation of the instructor as part of quantitative research were analysed and interpreted.The teacher observation is also included.

***Students questionnaire*:**

The author used manual coding and analysis, and for this purpose, she designed simple table to identify and organize themes. In the questionnaire**,** the author focused on point that: Was the written assignment helping students to learn the concepts and is it helpful in training them to solve the questions correctly in exams?The details students responses are in table 2.

Table 2. ***Data analysis of students' questionnaire of few students.***

Participant number	Strongly agree	Agree	Disagree	Strongly disagree	Not decided
1	√				
2	√				
3	√				
4		√			
5	√				
6			√		
7	√				
8	√				
9	√				

10		√			
11			√		
12	√				
13	√				
14	√				
15	√				
16					√
17		√			

Source: the author

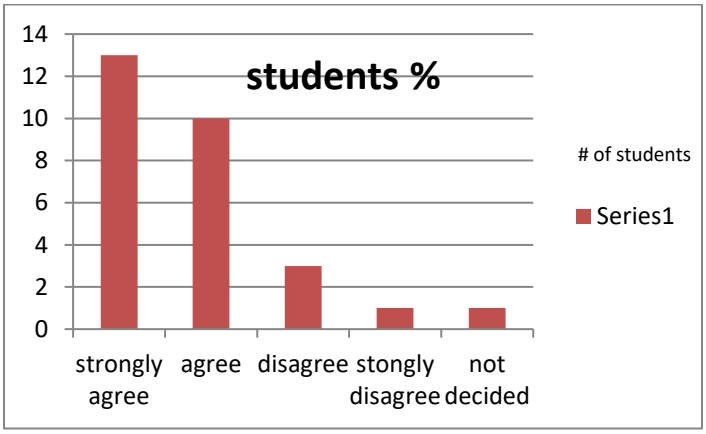


Figure.2.A chart shows the results of the data analysis

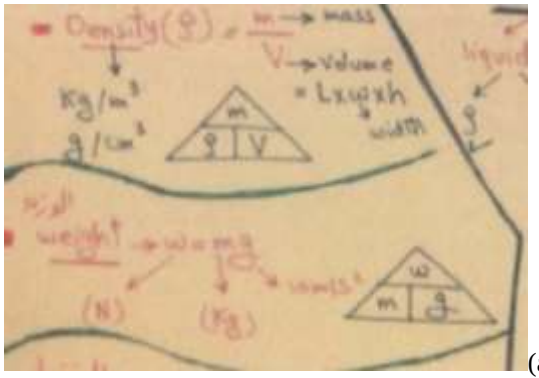
Discussion

Data interpretation:

According to the author the above participatory mode action research is giving oppurtunities to students including taciturn ones to learn,understand, and apply the scientific formulae they have learnt throughout course,despite language challenges. Usage of proper formulas and improvement in vocabulary and correct usage of scientific terms in the final exam papers increased,added with this, decrease in number of failures was observed,indicating improvement in proficiency in English language . Viva at the time of submission of formula and the enganement during office hours was in English languge.Many students not only learnt correct spellings but also showed a better understanding of terms like ‘’directly proportional’’ and

‘’inversly proportional’’ , “microscopic world’ “macroscopic” ‘’terminal velocity’’ ‘’mass and weight’’and so on and all this eventually helped them understand and write definitions of the acquired terms. As (Laplante, 1997) highlighted that considering the large number of technical terms used in science, it is unrealistic to expect students to acquire them without any formal teaching in a purely communicative context.

This observation was antithetical to first two years experience when it seemed extremely difficult to raise summative assessment grades.A benefit from this assignment also changed surface learning to deep learning and metamorphosed the students whose learning was mainly memorization based to knowledgeble students, overcoming English language disability in the pursuit of education.



(a)

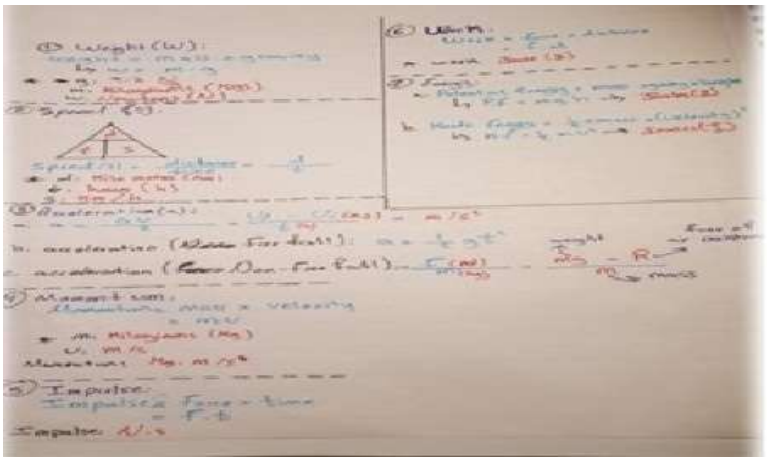

(b)

Figure.3. Samples a,b show correct understanding of formulas.

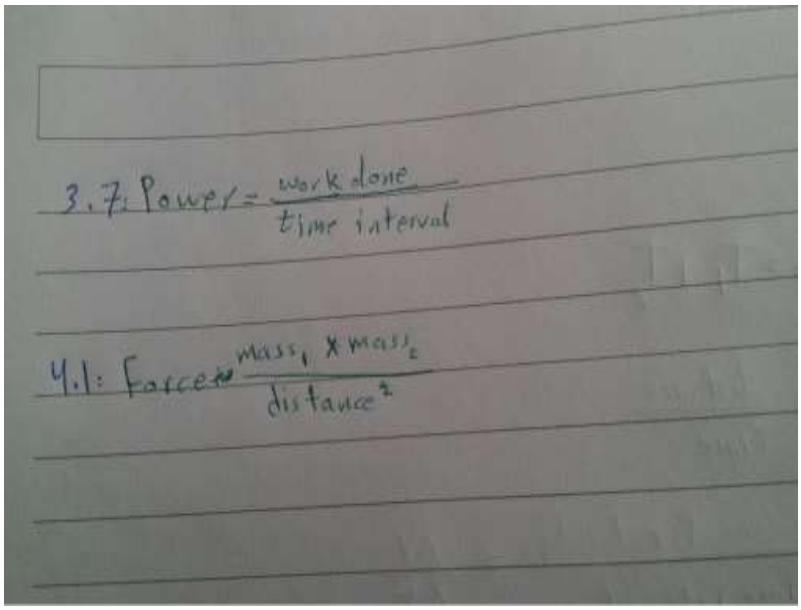


Figure.4.Forms of formulas which can not be used to solve numerical questions

Brent & Felder (1992) emphasize that the approach to deep learning is through Written assignments.Reflection from results showed that writing assignment is facilitating learning ,really having an impact. Students learning,understanding and implementation has improved by this project. The instructor is able to make the malleable students think in the framework of laws and formulas in order to apply them and solve and answer questions with better English proficiency. Interactivity between reader and text occurs as the reader makes connections and students are able to have all formulas and key terms in front of them any time or a night before the final exams to review and see the relation ship between physical quantities they learnt. Many students were able to overcome the hindrance from barrier of English language.As Brent and Felder further emphasize that the written assignments help students,where at times they find it difficult to understand and comprehend the words on their own.

The response and participation of students in the given assignment was that

1) Thirty to fifty percent of them knew what they were doing and in fact very impressive and clear information about each formula was given and they said assignment was very beneficial and few were used to doing it from before as a learning practice showing natural endowment as shown in figure 3.
2) Few of them wrote the terms in Arabic near the scientific terms apart from English.
3) For pliable rest of them the following was noted :

- They wrote few formulas of a chapter and left the rest, as they were not sure if those were included in the course?

- Some wrote the formulae not in the course,which were not taught to them and assignment seemed oblique with wrong equations in more than one form and many terms were missing.
- Some formulas they wrote, were with proportionality sign,which they were using unsuccessfully to solve problems as shown in figure 1.
- Use of proper standard units was missing.
- Few had written as it should be,but in viva they were not able to communicate in English.
- Fifteen percent copied from their friends, so had the same mistakes in formulae and in terms.
- Many of them wrote only short forms. So they were not sure, what each alphabet stands for?
- Spelling of terminology was not correct like "weight" was spelled as "weit".
- Some sent assignment through friends and did not collect it back, which partly did not serve the purpose of student learning.
- Insouciance four percent were not bothered to submit.
- Two percent said they were not aware of an assignment as such.

After the viva,the assignment was graded out of five marks.Weightage of this was out of two percent.On late submission marks were deducted and no marks were given when the assignment was not submitted.

Reflection from fact that the instructor had to submit report on grade inflation in this course at the end of the semester ,adjugates that writing assignment is facilitating learning and most students are resurgent even when the course is taught in English.

Summary of peer observation, discussion and suggestions

In the department meeting, discussion included review of grading policy and including the written assignment in it. The author/instructor expressed her concern about the less than expected and turbulent perfrormance of students in the final exam before the assignment was introduced.

The main focus for review was "How can the instructor make the learning of student deeper'' and "How can the instructor make them understand the relationship in the physical quantities in a formulae and their proper use?"even for a student who is less proficient in English language in order to enhance students performance.

The set criteria to be used were to 'look at the incorrect answers in the quizzes,majors and exam, the reason why students are choosing incorrect answers', 'also to look at the way they are solving numericals, and theory based questions', and to review the grading policy of summative assessement and to answer the above mentioned questions.In the discussion, the instructor suggested to include the written assignment based on all the formulas covered in the course, in the grading policy. Furthermore, the instructor would welcome more information associated with a formula by the students in the assignment which would further enhance their English language writing skills and science education. Finally input from the colleagues was considered as to

whether the assignment should be graded and if so,for how much weightage? And also should it be part of grading policy or each instructor can modified according to student cohort they teach?

Implementing the action plan

The instructor modified and upgraded the guidelines regarding the ensemble of formula assignment after its implementation. Most of the students were not clear as to the format of the assignment. So the instructor wrote one formula as an example in one of the classes.The announcement time and method and reminder policy also was modified.This was done as some students do not start attending the classes from first day of the semester and some forget even after knowing about it in the beginning. Later assignment was promulgated on moodle as a reminder.

Students' evaluation after the action plan

The standard students' evaluation usually includes 24 questions. However, for the purpose of this research, the instructor has included questions that are directly related to implementation of the 'Action Research'. At the end of each semester after the final exams,its mandatory that students fill the online evaluation to view their results.

The online students' evaluation shown in Table 3 includes questions which reflect feedback from students.The percentage students who strongly agree and agree for each question is as follows 1) 88.6% 2) 86.6% 3) 88.2% 4) 87.4%.5)86% 6) 88% 7) 86.6% 8) 85% 9) 85.4% 10) 84.8% 11) 85.8% and finally for question 12) 85%.

Table.3. ***Students' evaluation after implementing my action plan***

Questions	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1. The instructor was enthusiastic about the course.	58.82	29.41	9.8	0	1.96
2. The instructor cared about my progress in the course.	58.82	23.53	11.76	3.92	1.96
3. The instructor had thorough knowledge of content of the course.	60.78	29.41	7.84	0	.1.96
4. The instructor cared about my progress.	58.82	23.53	11.76	3.92	1.96
5. The instructor was available during office hours.	58.82	29.41	7.84	0	3.92
6. The instructor encouraged me to ask questions and develop my own ideas.	58.82	27.45	11.76	0	1.96
7. The instructor inspired me to do my best work.	54.9	33.33	5.88	1.96	3.92
8. Class activities, assignments, laboratories etc. helped me acquire the knowledge and skills intended by the course.	52.94	29.41	9.8	3.92	3.92
9. This course helped me to improve my ability to think and solve problems rather than just memorize information.	52.59	31.37	9.8	1.96	3.92

10. Grading of my tests and assignment was fair and reasonable.	60.78	27.45	5.88	1.96	3.92
11. This course improved my ability to communicate effectively.	52.94	29.41	11.76	3.92	1.96
12. Overall, I was satisfied with the quality of this course.	56.86	23.53	13.73	0	5.88

Source: Prince Sultan university

Students comments in open ended questions of evaluation for :What did you like most about this course?One of the students responded that she learnt a lot in the instructors class as she is very knowledgeable in her field and makes material interesting.The above was no less than an accolade for the instructor.

Review and redesign the course grading policy

In order to improve the quality of teaching and learning of the concerned class, and to implement the recommendations of the 'Action Research', the instructor has reviewed and amended the Course grading policy of the conceptual physical science course.This demonstrates a formative use of a summative test.(Garrison & Ehrlnghaus, 2010).

The instructor findings reflected what was highlighted by(Sadler, 2005), it does include adequate reference to criteria-based grading and curriculum development that supports self-referenced assessment and grading, in which the reference point for judging the achievement of a given student is that student's previous performance level or levels. What counts then is the amount of improvement each student makes.

For example, the instructor has amended areas of section(C) course description of course specification like-Development of Learning Outcomes, in Domains of Learning,focusing on specific areas like knowledge to be acquired,Skills to be developed, Numerical and Communication Skills and methods of assessment including Scheduling of Assessment Tasks for Students and section (G) of the course specifications, concerning course evaluation and improvement processes, taking into consideration action planning arrangements for periodically reviewing course effectiveness and planning for improvement. Moreover, the instructor has updated the specified objectives to embrace student centered assessment and reinforce the ideas learnt so that the instructor can improve specific area related to Processes for Verifying Standards of Student Achievement mentioned in section (G) of course specification.

These written assignments were underpinned by cognitive theory.Students earn points for engagement in the process of learning and for progress toward mastery of standards as demonstrated by the student's written and spoken performance(Jones Miller, 2013).The examples do exhibit part of the variety of ways in which enhanced formative work can be embedded in new modes of pedagogy. In particular, it can be a salient and explicit feature of an innovation, or an adjunct to some different and larger scale movement-mastery of learning.(Black & Wiliam, 2006)

When amending the concerned course specification document, the instructor has tried to engage adequate articles and journals related to grading policies and collaborated with associated

colleagues towards cooperation and integration in an effort to allow faculty members implementing and supporting the amended grading policy. Transformation through structured education discussed in vertical and horizontal integration of education with focus on the suggestion of a hierarchy of six levels,achieved by well organized learning process. ("Chapter 2 Vertical and Horizontal Integration of Education," 2000) These six categories are the cognitive domain levels of Bloom's Taxonomy of Educational Objectives (Bloom 1984) Knowledge (repeating verbatim),Comprehension (demonstrating understanding of terms and concepts),Application (solving problems),Analysis (breaking things down into their elements, formulating theoretical explanations or mathematical or logical models for observed phenomena),Synthesis (creating something, combining elements in novel ways),Evaluation (choosing from among alternatives) were achieved through this assignment.

The redesining of grading policy by the author also considered students evaluation and questionare.As student opinions are important and should be including in any assessment plan, meaningful evaluation of teaching must rely primarily on assessment of learning outcomes.(Brent & Carolina, 1999)

Considering outcomes based approach within the amended course curriculum

In reviewing and amending the concerned Curriculum Specifications, the instructor has employed an adequate Outcomes Based Approach. In the Course Objectives section, the instructor has included assessment methods which help superficial learning transform into deep learning and aiming to enhance performance in summative assessment by overcoming learning disabilities.This is also supported by the introduction of graded assignments, implemented and expressed in the course learning objectives section of the Course Specification Document. Facts are not simply facts to be remembered in isolation.(Duffy & Jonassen, 1992) There is alignment all the way through, from objectives through teaching method, to assessment: all involve focusing on students doing what they should be doing, solving professional problems. The central issue is putting knowledge to work.(Biggs, 2003)

Amending assessment to link the subject to local multicultural students and resources

The instructor has amended the assessment method in multicultural classes in order to develop strategies to improve quality of summative assessment by enhancing the usage of scientific formulas and reasoning and improved language skills,in an attempt to link the diversification and the nature of such course concerned with Physical Sciences.

The instructor has also introduced advanced writing assignment to develop cognitive skills of students which is an important domain in learning outcome in the course specification document, as well as the "course objectives".The instructor has improved students' engagements and participation leading to overcoming English language challenge(Rogier, 2012).Moreover, the instructor increased the opportunities for improving interaction between instructor and students leading to discussions in English outside the class and promoted face to face feedback and improve course learning outcomes.Nevertheless, the formative assessment still can be improved and the feedback from them can be used to plan strategies to improve summative assessment and engage students to develop multiple skills in this learning process with increase in English

proficiecy.Since every learner will have a unique perspective entering the learning experience and leaving the experience.(Duffy & Jonassen, 1992).

Updating the course assessments criteria, modes and creating opportunities for formative and summative assessments.

When amending the methods of assessment as described in this course specifications(Action planning arrangements for periodically reviewing course effectiveness and planning for improvement strategies for obtaining student feedback on effectiveness of teaching), the author found them in line with the university requirements, and followed the suggested assessment methods demonstrated on this private university template. This is delivered through assessment tasks during the semester which forms 60%, while the final assessment forms 40%.

The instructor notably amended the outside classwork and interactions throughout the semester to include more students engaging assignments such as writing tasks.The wide range of topics covered in assignments created good opportunities for enhancement of formative assessments such as quizzes and simultaneously provided ample and advance practice for summative assessment and enabling students to, not only overcome learning disabilities but also foster academic language proficiency and confidence.

Quality assurance guidance and procedures in supporting the course curriculum

The instructor revised and amended the course specifications document to enhance summative assessment performance. Adequate amendments were also included in the sections concerning grading policy.According to Hounsell in a surface approach, what was to be learned was interpreted as the text itself. In a deep approach, the text was seen as a means through which to grapple with the meaning which underlay it.(Hounsell, 1984)

For example, the instructor/researcher introduced the assessment tasks such as writing assignment throughout the semester, to ensure students' engagement and enabling learning. Furthermore, she graded the assignment to motivate the students and included it in grading policy.This practice also helped develop the student-instructor interaction, as well as opportunities were triggerd for clearing doubts and students going through the course hand out and being aware of what is not included in the course and getting effective and quick feedback. The communication was in English language and the teacher used evey oppurtunity to improve language proficiency needed for the course and scientific literacy through writing ,talking and enhancing the usage of scientific formulas.Eventually,results showed a varitable increase in students scores and students' failure rate dropped and the assignment espouse students pursuit of academic achiement and fortified their confidence.However, there are still many opportunities for improvement such as including similar graded assignments including research in the course syllabus. Research and development is one of the most influential factors that increases the quality of education.(Alshayea, 2012).Bringing students to the forefront of research forums and conducting more supervised research in the related areas could be a successful tool in order to improve higher education.The knowledge of facts acquired in the form of scientific formulae through out the course can be made innovative through research.

Conclusion

The 'action plan' associated with this research paper proved nascent and has helped to identify, investigate and analyze the learning disabilities of students less proficient in English language and what weakened or tempered their summative performance was tracked. In order to do so, the instructor reviewed and assessed the areas in the answer sheet of majors and quizzes, as well as the course teaching strategies and assignments.This improved instructors practices and made the author more aware and professional.For example the author followed with the students who scored grades below B from first quiz and keenly observed their usage of scientific formulae.This action plan also lead to improving the course structure instead of maintainig as it is.

Research objectives were accomplished by the author by implementing the research 'action plan'.The first objective was to help students achieve better grades in the final exam by overcoming learnig disabilities due to lack of English language proficiency and modify assignments to suit students learning style and communicate to even taciturn students outside the class. This was achieved by introducing new writing assignment as recommended by the three tools of the 'action research'; personal observation, students' dairy writing and facilitating.

This action research has really mitigated even the defedant students to learn,understand, and apply the formulae they have learnt throughout the course improving their formal reasoning skills with regard to scientific formulae and English languge aquisition. There was decrease in number of failures,appropriate formulas were used and correct usage of Engligh language in answers showed improvement.Added to this,mistakes in solving formula based questions and scientific terms and other words decreased significantly. A benefit from this assignment also changed surface learning to deep learning and students vocabulary in English was promoted.This objective was achieved by asking students to solve applications based and descriptive questions from the course materials based on the formulae they were taught and they were writing assignment on.

Furthermore,the other objective achieved was students were aware of the topics which are the part of their syllabus.In earlier semesters it was noticed that students were practicing even those formulas which were not taught to them.This assignment was a practice for them to get to know the excluded part of each chapter.The overall performance and the grades improved dratically.The post Action Plan students evaluation showed that students became more interested in the course and this promoted the endowment of effective skills in doing the assignment.Finally,this proved propitious design and implementation of the 'action research'and opened a path of improving teaching directed by problematic areas.After the success of this research, other physical science instructors have used this assignment and reported improvement in their students performane too by practicing this assignment.

Future implications

Planning and executing the 'action research' gave the instructor beneficial experience and prodigious confidence to continue using the propitious assignment in the future by refining it and including steps in the assignment to find cross connections beween the formulae and ask students to write a report on these connections in order to do advanced level questions.This would further

solve students paradox in comprehension of formulae and enhance their English writing skills and improve their cognitine academic proficiency.Moreover promulgating this assignment through moodle and starting a forum on moodle to help greater interaction between students and also with the instructor would be interesting.Research on the basis of facts gathered during the assignment used for innovation could be interesting and bloster multidisciplenary interest.The instructor/author will plan to have above strategies applied in the next following semesters as university is a place where creative minds construct visions in order to enhance and enrich teaching and learning experiences.

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