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# Attitudes of Higher Secondary Learners Relating to the Physics Curriculum: Alignment Analysis

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## Abstract

Alignment analysis refers to the degree of alignment between the content or objectives of a curriculum and the assessments or standards to evaluate students' learning. In general, it is recorded and examined as Curriculum Alignment in various educational contexts. The present paper explores level of alignment in physics curriculum based on knowledge, understanding, application, and skills towards attitudinal areas of learning Physics. 481 Higher Secondary learners were made respondents for collecting Attitude data using ATSS-MS scale from Physics learners using descriptive method. The data was normally distributed. Standard alignment was tabulated using blueprint from the Council of Higher Secondary Education, Manipur (COHSEM) syllabus of Physics. The alignment was calculated between attitudes of learning Physics and the domains of knowledge, understanding, application and skills. It was found that there was no alignment with application domain; negative alignment with understanding; positive alignment with skills domain, and there were significant differences in the alignment of knowledge domain. Attitude like change of opinion after getting evidence and respect for others' views were found to be significantly different and concluded with the view that the existing Physics curriculum for Higher Secondary stage was found to be unfavourable with the attitudes of learning Physics. It was also observed that Physics learning was less activity oriented, but more into literature reading, inadequate practical experience, etc., which is boring and doesn't involve problem-solving giving space to negative attitude.

**Keywords:** Alignment, Attitude, Physics, Curriculum, Secondary.

## Introduction

Alignment in curriculum refers to the degree of expectations, assessments, and activities, which work together to guide learning (1-4). It is rooted in the belief that instructional plans are established through outcomes-based content goals and the goal of assuring that delivery and assessment are congruent (5). Alignment in curriculum is categorically classified into internal or triadic alignment - activities, assessments, and objectives (6) and external alignment - standardized comparison, content of different courses, and learning outcomes (7). There are different approaches to curriculum alignment - Constructive Alignment Approach (8), Webb's Surveys of Enacted Curriculum (SEC) approach, Single Alignment Index (SAI) approach, Vertical and Horizontal alignment (VHA) approach (9-12). Porter classified alignment of assessment into three ways – alignment with content standards, instructions with assessments, and instructions with instruction. Alignment is crucial in education policy efforts, and there have been innovations in alignment technique, such as calculating critical values for alignment indices and establishing the minimal number of raters required for trustworthy results. Current alignment techniques may be impractical and time-consuming for teachers, and there is a need for technologies that automate the alignment process and provide instructors with meaningful findings (13, 14).

Logically, attitudes are ethics, competencies towards imagination. Attitude towards science include the components like causal relationship, critical mindedness, curiosity, evidence seeking faith in scientific, identification, intellectual honesty, open mindedness, objectivity, observation, and verification (15-18). Learners' attitudes towards Physics have significant factor in their academic performance and understanding of Physics; it has also been shown that both students'



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attitudes and teachers' attitudes towards Physics play a role in achievement (19, 20). Procrastination as a habit of studying develops negative impact on students' performance in Physics (21). On the other hand, a positive attitude towards Physics can be fostered through a conducive learning environment and the use of effective teaching strategies (22). Problem-based learning has been found to be an effective method of teaching Physics and can lead to a more positive attitude towards the subject (23). Therefore, it is important to assess the attitudinal contents that promote a positive attitude towards Physics to create a supportive learning environment.

The objective of the present paper is to explore the level of alignment in Physics curriculum based on knowledge, understanding, application, and skills on the contents of Physics syllabus prescribed by Council of Higher Secondary Education, Manipur (Class XI and XII) with references to the attitudinal areas of elimination of belief in superstition, curiosity to know, open mindedness, facts with proof, critical evaluation, change of opinion with evidence, discovering attitude, and respecting others' views.

Research on attitude and instructional methods affect students' academic performance, teachers' qualification impacts students' academic progress (19). Again, students' attitudes towards Physics in Nine Year Basic Education (9YBE) in Rwanda was boring and learners of rural schools struggled with problem-solving while learning physics (24). Similarly in Ghana, majority of students had a negative perception towards the study of Physics. Students who did not study Physics had negative attitudes towards the subject (25). Cermik and Kara explored factors related to learning Physics such as interest, unwillingness, academic self and necessity. The Cronbach's Alpha reliability coefficients of the factors were 0.911 for Interest, 0.906 for Unwillingness, 0.845 for Academic self and 0.782 for Necessity. The Cronbach's Alpha value for the entire scale was 0.936. It was an effective measurement instrument to determine and monitor High school students' attitudes towards the Physics course (26). Students' attitude was analysed towards Physics learning from 926 senior High school students and found that students' attitude is at Good Category based on indicators like social implication of physics and adoption of scientific attitude. The average students have a good attitude on the indicator with a relevant correlation between social implication and adoption of scientific attitude. A contrasting review was that students perceived Physics as a difficult subject during High school days and become more evasive when they started college. It shows that there is no significant difference in the attitude and motivation of students towards learning Physics. The relationship between attitude and motivation in learning Physics is due to chance (27, 28). Right attitude indicates social implications, sufficient attitude as normality of scientists, and enough attitude as career in physics (29). The context of teaching materials based on inquiry approach, which had more positive attitudes towards Physics (30). Veloo et al. explored six variables, which reflects attitude towards Physics— career related to Physics, importance of Physics, difficulty of understanding Physics, Physics teachers and Physics equipment usage, and found that positive attitude improves achievement in Physics, and cooperation and effective teaching methods increase positive attitude (31). Balta and Eryilmaz also found out that Physics teacher's attitudes toward changes are positive, but an in-service trainee needs training of positive attitudes towards gender. Public and private school teachers played a significant role in shaping positive attitude (32). Lastly, Physics is considered to be a difficult but pleasant and interesting subject, with use not only for oneself but for others as well (33).

## Material and methods

Method: Descriptive method under quantitative research design was used for the present study targeting the alignment of curriculum in Higher Secondary Physics syllabus of Class XI and XII (containing 19 units: 10 units from class XI and 9 units from class XII) with 8 different attitudinal areas.

Sample: 481 higher secondary learners, enrolled under Council of Higher Secondary Education, Manipur (COHSEM) during the year 2021-22 were taken as respondents and tested for attitudes towards Physics curriculum alignment. The Alignment was tested on areas of elimination of belief in superstition, curiosity to know, open mindedness, facts with proof, critical evaluation, change of opinion with evidence, discovering attitude, and respecting other views. The collected

data based on attitude towards Physics curriculum was tested for its normality using Shapiro-Wilk test; the statistical result was as SW (481) = 0.995, p=0.161 at 0.05 level of significance. It was found to be normally distributed.

**Tools and techniques:** Attitude towards Science Scale (ATSS-MS) developed to collect data for attitude from the physics learners in the present study. The internal consistency α- reliability was found to be 0.775 with scale mean 252.90±24.258 with 8 dimensions. A checklist of the dimensions elimination of belief in superstition (CAE1), curiosity to know (CAE2), open mindedness (CAE3), facts with proof (CAE4), critical evaluation (CAE5), change of opinion with evidence (CAE6), discovering attitude (CAE7), and respecting other views (CAE8) was also tabulated (Table 1) along with the contents of the syllabus of Physics, and blueprint for theory (K: Knowledge; U: Understanding; A: Application and S: Skills) of COHSEM for both Class XI and Class XII as shown in Table 2. First a correlation of the 8-dimension related to attitude towards Physics curriculum was calculated. Again, the correlation value was subtracted from the standard content value as given by the COHSEM in domains of Knowledge, Understanding, Application and Skills. The differences are tabulated as a matrix of Knowledge and content-units. The cell values of each matrix are subtracted from the normal alignment unit 1(one) and the differences are again plotted as in the form of a matrix of alignment.

The proposed alignment was calculated in the line of porter alignment (1, 11) with conceptual modification for inserting variables towards alignment. A proposed general step for calculation of alignment could be as such – 1) COD (Content of Domain): Preparation of a standard distribution based on the content or syllabus as standard alignment by selecting domain(s) from the blueprint (Knowledge, Understanding, Application, Skill, etc.) 2) COE (Calculation of Element): Preparation of elements based on the distribution of marks - unit wise or different categories or levels or standards or credits. 3) COR (Calculation of 'r' coefficient of correlation): Calculation of 'r' for variables which need alignment with COE distribution. 4) COA (Calculation of Alignment): Preparation on difference matrix between the element of COE and COR i.e., COA= COE – COR. 5) COB (Calculation of Balancing): The element(s) of COA are subtracted from a unit of one for balancing the normal distribution of the alignment i.e., COB=1-COA. 6) DOV (Distribution of Value of alignment): The value of the alignment may range from negative to positive. The index may range from negative alignment (less than -1.0); no alignment (between -0.99 to 0.00); perfect alignment (alignment value =1.00) and positive alignment (greater than 0.001). Lastly, an average was calculated with a crosstabulation between contents and the domain. The value was tested for its observation using chi-square.

**Procedure:** Application was made to the principal, head-teachers of Higher secondary schools in the valley districts of Manipur. It was a difficult task to collect data during the post-Covid phase as the schools were bound by strict post-Covid protocols. Upon getting the required approval, the data was collected from Higher Secondary schools offering physics as a science subjects. The ATSS-MS scale consists of 75 items and it took 23 minutes on an average to complete a questionnaire. On an average 32~35 sample were collected on an appointment day with post Covid-19 measures. Thus, the whole data were collected during the months of March-April, 2023.

## Result and Discussion

Data analysis: The present study observed significant attitudinal agreed statements from Physics learners such as 'Physics systematized our existence', 'learner's activity is less now', 'it is a heap of truth', 'now it is like literature reading', 'superstitions and taboos are fading away', 'it increases reasoning', 'develops scientific attitude', 'spirit of enquiry', 'shortened the world'. Most interesting observation was that 51 percent of the sample strongly agreed on the statement that 'Physics revolutionized our way of learning', while 24 percent were undecided on the statement even though they are Physics learners at the Higher Secondary stage. Again, strongly agreed observation was found on inadequate statements such as— practical and activities provision in the curriculum, diagnosis of diseases properly, part to be a general education, textbooks, scientific attitude. It was also found that 55 percent of the samples over the item-improvisation in science were undecided as an inspiration to explore/discover and invent new things. Many

Physics learners were undecided on the importance of the statement 'Science Clubs inculcate a scientific attitude', undecided on 'Science helps in development of physical and mental health' and it increases the capacity to know the unknown. 32 percent of the sample were undecided on their attitude that Science has a cultural value. 73 percent of the sample agree that 'Science is the only subject which offers the pupils a large number of activities', however, 52 percent explain that Physics has failed to find a respectable place in Higher Secondary School curriculum. 66 percent express experimental work is neglected in science learning. 49 percent of the sample Physics learners like to watch TV shows on Physics, and think it is important only at school. 80 percent of the sample Physics learners agreed that they learnt more from doing experiments than from listening to teacher's explanation and reading books. 52 percent of the sample Physics learners are interested in many scientific facts that are not taught at school and also know where to find science questions related to Advanced Physics. 49 percent of the sample learners are not aware about how to set up a scientific investigation even though they are Physics learners of Higher Secondary stage of school education in India.

Table 1 depicts the internal consistency of the attitudinal elements towards Physics curriculum among the Higher Secondary learners. It was found that there was higher internal consistency Cronbach alpha greater than 0.600 in all the eight elements, which marks the acceptance of the element as attitudinal towards physics learners. Again, table 2 shows the distribution of content of physics in terms of knowledge, understanding, application and skills. It is the blueprint for theory or standard alignment of Higher Secondary Physics curriculum of COHSEM. It was found to be distributed theoretically as 20 percent knowledge, 46 percent understanding, 30 percent application and 4 percent on skills. Higher contents were included on Optics, Oscillation and Waves, Properties of Bulk Matter, Laws of Motion and Contents of Kinematics. The least contents were included on 'Physical World and Measurement' as well as Electromagnetic Waves. Table 3 shows the correlation values of the attitudinal aspects towards curriculum alignment and shows highest significant correlation with the content of Physics with the attitude of curiosity to know r=0.770, and the lowest correlation with Change of opinion after getting evidence r=0.350. In Table 4, it was found that Kinematics, Laws of Motion, Properties of Bulk Matter, Oscillation and Waves, Electrostatics, Magnetic effect of current and magnetism, Electromagnetic Induction, Alternating Current and Optics have 'no or negative alignment' towards knowledge domain in all the eights attitudes of Physics learning at the Higher Secondary stage. Still, in the understanding domain as shown in table 5, it was only two contents – Physical world and measurement, and Electromagnetic waves were positively aligned and the remaining 17 contents were 'no or negatively aligned' with all the eights attitudinal elements of learning Physics at the Higher Secondary stage. Similarly, in the application domain, as shown in table 6, it was depicted that 'Physical world and measurement, Gravitation, Thermodynamics, Behaviour of Perfect Gas and Kinetic theory, Electromagnetic waves, and Dual nature of Matter and Radiation' were positively aligned, leaving 13 contents with 'no or negative alignment' with the attitudinal elements of learning Physics. Lastly, positive alignment was found as shown in table 7 with all the contents and attitudinal elements in the domains of skill in relation to Physics learning at the Higher Secondary stage, but no perfect alignment was found in all domains of knowledge, understanding, application and skills with the eight attitudes of learning physics at the Higher Secondary stage. On an average, there was negative alignment in understanding and application domain in all the eight attitudes of learning physics at the Higher Secondary stage, positive alignment for skills domain and significant differences were observed in the alignment of knowledge domain. Two attitudes namely – change of opinion after getting evidence (CAE6) and respect for others' views (CAE8) were found to be significantly different [$\chi^2(1)=7.688$; $p=0.006<0.05$; $\chi^2(1)=36.992$; $p=0.000<0.05$; respectively] and negatively aligned in the three domains of the standard contents of physics curriculum in terms of knowledge, understanding, and application. Thus, the present Physics curriculum for Higher Secondary stage at COHSEM was found to be unfavourable with the attitudes of

**Table 1:** Dimensions of attitudes towards physics learners

| Elements | Mean | Std. Deviation | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Squared Multiple Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|---|---|
| CAE1 | 13.24 | 2.341 | 239.67 | 530.615 | 0.485 | 0.284 | 0.707 |
| CAE2 | 55.58 | 7.801 | 197.32 | 352.372 | 0.598 | 0.570 | 0.658 |
| CAE3 | 47.06 | 5.935 | 205.84 | 406.504 | 0.613 | 0.448 | 0.652 |
| CAE4 | 61.48 | 7.840 | 191.42 | 359.431 | 0.564 | 0.459 | 0.670 |
| CAE5 | 30.28 | 4.085 | 222.62 | 476.582 | 0.534 | 0.288 | 0.682 |
| CAE6 | 28.01 | 5.247 | 224.89 | 531.007 | 0.124 | 0.342 | 0.756 |
| CAE7 | 10.46 | 2.019 | 242.45 | 537.398 | 0.502 | 0.319 | 0.710 |
| CAE8 | 6.79 | 1.788 | 246.11 | 551.273 | 0.405 | 0.188 | 0.719 |

**Table 2:** Distribution of standard content of physics curriculum alignment

| Class | Units | Contents | Code | Marks | K | U | A | S |
|---|---|---|---|---|---|---|---|---|
| 11 | U1 | Physical World and Measurement | U1C11 | 3 | 0.60 | 1.37 | 0.90 | 0.13 |
| 11 | U2 | Kinematics | U2C11 | 10 | 2.00 | 4.57 | 3.00 | 0.43 |
| 11 | U3 | Laws of Motion | U3C11 | 10 | 2.00 | 4.57 | 3.00 | 0.43 |
| 11 | U4 | Work, Energy and Power | U4C11 | 6 | 1.20 | 2.74 | 1.80 | 0.26 |
| 11 | U5 | Motion of System of Particles and Rigid Body | U5C11 | 6 | 1.20 | 2.74 | 1.80 | 0.26 |
| 11 | U6 | Gravitation | U6C11 | 5 | 1.00 | 2.29 | 1.50 | 0.21 |
| 11 | U7 | Properties of Bulk Matter | U7C11 | 10 | 2.00 | 4.57 | 3.00 | 0.43 |
| 11 | U8 | Thermodynamics | U8C11 | 5 | 1.00 | 2.29 | 1.50 | 0.21 |
| 11 | U9 | Behaviour of Perfect Gas and Kinetic Theory | U9C11 | 5 | 1.00 | 2.29 | 1.50 | 0.21 |
| 11 | U10 | Oscillations and Waves | U10C11 | 10 | 2.00 | 4.57 | 3.00 | 0.43 |
| 12 | U1 | Electrostatics | U1C12 | 9 | 1.80 | 4.11 | 2.70 | 0.39 |
| 12 | U2 | Current Electricity | U2C12 | 7 | 1.40 | 3.20 | 2.10 | 0.30 |
| 12 | U3 | Magnetic effect of current & Magnetism | U3C12 | 9 | 1.80 | 4.11 | 2.70 | 0.39 |
| 12 | U4 | Electromagnetic Induction and Alternating current | U4C12 | 8 | 1.60 | 3.66 | 2.40 | 0.34 |
| 12 | U5 | Electromagnetic Waves | U5C12 | 3 | 0.60 | 1.37 | 0.90 | 0.13 |
| 12 | U6 | Optics | U6C12 | 15 | 3.00 | 6.86 | 4.50 | 0.64 |
| 12 | U7 | Dual Nature of Matter and Radiation | U7C12 | 5 | 1.00 | 2.29 | 1.50 | 0.21 |
| 12 | U8 | Atoms and Nuclei | U8C12 | 7 | 1.40 | 3.20 | 2.10 | 0.30 |
| 12 | U9 | Electronic Devices | U9C12 | 7 | 1.40 | 3.20 | 2.10 | 0.30 |
| | | Total Mark | | 140 | 28 | 64 | 42 | 6 |

**Table 3:** Attitudinal aspects towards curriculum alignment

| Attitude Aspects | r correlation |
|---|---|
| Elimination of Superstition (CAE1) | 0.565 |
| Curiosity to know (CAE2) | 0.770 |
| Open Mindedness (CAE3) | 0.759 |
| Facts with proofs (CAE4) | 0.759 |
| Critical Evaluation (CAE5) | 0.652 |
| Change of opinion after getting Evidence (CAE6) | 0.350 |
| Attitude to discover (CAE7) | 0.545 |
| Respect for others' views (CAE8) | 0.458 |

**Table 4:** Alignment of physics curriculum with attitudinal elements on knowledge domain

| Content | CAE1 | CAE2 | CAE3 | CAE4 | CAE5 | CAE6 | CAE7 | CAE8 |
|---|---|---|---|---|---|---|---|---|
| U1C11 | 0.97 | 1.17 | 1.16 | 1.16 | 1.05 | 0.75 | 0.95 | 0.86 |
| U2C11 | -0.44 | -0.23 | -0.24 | -0.24 | -0.35 | -0.65 | -0.46 | -0.54 |
| U3C11 | -0.44 | -0.23 | -0.24 | -0.24 | -0.35 | -0.65 | -0.46 | -0.54 |
| U4C11 | 0.37 | 0.57 | 0.56 | 0.56 | 0.45 | 0.15 | 0.35 | 0.26 |
| U5C11 | 0.37 | 0.57 | 0.56 | 0.56 | 0.45 | 0.15 | 0.35 | 0.26 |
| U6C11 | 0.57 | 0.77 | 0.76 | 0.76 | 0.65 | 0.35 | 0.55 | 0.46 |
| U7C11 | -0.44 | -0.23 | -0.24 | -0.24 | -0.35 | -0.65 | -0.46 | -0.54 |
| U8C11 | 0.57 | 0.77 | 0.76 | 0.76 | 0.65 | 0.35 | 0.55 | 0.46 |
| U9C11 | 0.57 | 0.77 | 0.76 | 0.76 | 0.65 | 0.35 | 0.55 | 0.46 |
| U10C11 | -0.44 | -0.23 | -0.24 | -0.24 | -0.35 | -0.65 | -0.46 | -0.54 |
| U1C12 | -0.24 | -0.03 | -0.04 | -0.04 | -0.15 | -0.45 | -0.26 | -0.34 |
| U2C12 | 0.17 | 0.37 | 0.36 | 0.36 | 0.25 | -0.05 | 0.15 | 0.06 |
| U3C12 | -0.24 | -0.03 | -0.04 | -0.04 | -0.15 | -0.45 | -0.26 | -0.34 |
| U4C12 | -0.04 | 0.17 | 0.16 | 0.16 | 0.05 | -0.25 | -0.06 | -0.14 |
| U5C12 | 0.97 | 1.17 | 1.16 | 1.16 | 1.05 | 0.75 | 0.95 | 0.86 |
| U6C12 | -1.44 | -1.23 | -1.24 | -1.24 | -1.35 | -1.65 | -1.46 | -1.54 |
| U7C12 | 0.57 | 0.77 | 0.76 | 0.76 | 0.65 | 0.35 | 0.55 | 0.46 |
| U8C12 | 0.17 | 0.37 | 0.36 | 0.36 | 0.25 | -0.05 | 0.15 | 0.06 |
| U9C12 | 0.17 | 0.37 | 0.36 | 0.36 | 0.25 | -0.05 | 0.15 | 0.06 |

**Table 5:** Alignment of physics curriculum with attitudinal elements on understanding domain

| Content | CAE1 | CAE2 | CAE3 | CAE4 | CAE5 | CAE6 | CAE7 | CAE8 |
|---|---|---|---|---|---|---|---|---|
| U1C11 | 0.19 | 0.40 | 0.39 | 0.39 | 0.28 | -0.02 | 0.17 | 0.09 |
| U2C11 | -3.01 | -2.80 | -2.81 | -2.81 | -2.92 | -3.22 | -3.03 | -3.11 |
| U3C11 | -3.01 | -2.80 | -2.81 | -2.81 | -2.92 | -3.22 | -3.03 | -3.11 |
| U4C11 | -1.18 | -0.97 | -0.98 | -0.98 | -1.09 | -1.39 | -1.20 | -1.28 |
| U5C11 | -1.18 | -0.97 | -0.98 | -0.98 | -1.09 | -1.39 | -1.20 | -1.28 |
| U6C11 | -0.72 | -0.52 | -0.53 | -0.53 | -0.63 | -0.94 | -0.74 | -0.83 |
| U7C11 | -3.01 | -2.80 | -2.81 | -2.81 | -2.92 | -3.22 | -3.03 | -3.11 |
| U8C11 | -0.72 | -0.52 | -0.53 | -0.53 | -0.63 | -0.94 | -0.74 | -0.83 |
| U9C11 | -0.72 | -0.52 | -0.53 | -0.53 | -0.63 | -0.94 | -0.74 | -0.83 |
| U10C11 | -3.01 | -2.80 | -2.81 | -2.81 | -2.92 | -3.22 | -3.03 | -3.11 |
| U1C12 | -2.55 | -2.34 | -2.36 | -2.36 | -2.46 | -2.76 | -2.57 | -2.66 |
| U2C12 | -1.64 | -1.43 | -1.44 | -1.44 | -1.55 | -1.85 | -1.66 | -1.74 |
| U3C12 | -2.55 | -2.34 | -2.36 | -2.36 | -2.46 | -2.76 | -2.57 | -2.66 |
| U4C12 | -2.09 | -1.89 | -1.90 | -1.90 | -2.01 | -2.31 | -2.11 | -2.20 |
| U5C12 | 0.19 | 0.40 | 0.39 | 0.39 | 0.28 | -0.02 | 0.17 | 0.09 |
| U6C12 | -5.29 | -5.09 | -5.10 | -5.10 | -5.21 | -5.51 | -5.31 | -5.40 |
| U7C12 | -0.72 | -0.52 | -0.53 | -0.53 | -0.63 | -0.94 | -0.74 | -0.83 |
| U8C12 | -1.64 | -1.43 | -1.44 | -1.44 | -1.55 | -1.85 | -1.66 | -1.74 |
| U9C12 | -1.64 | -1.43 | -1.44 | -1.44 | -1.55 | -1.85 | -1.66 | -1.74 |

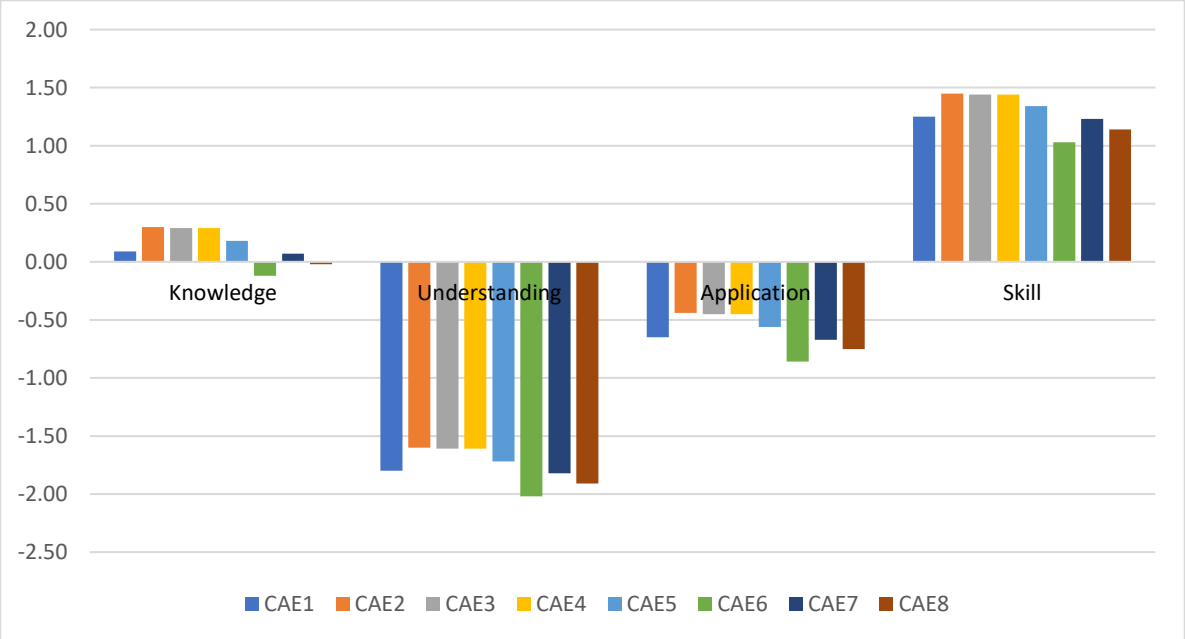


**Figure 1:** Alignment analysis on attitudes of learning physics

**Table 6:** Alignment of physics curriculum with attitudinal elements on application domain

| Content | CAE1 | CAE2 | CAE3 | CAE4 | CAE5 | CAE6 | CAE7 | CAE8 |
|---|---|---|---|---|---|---|---|---|
| U1C11 | 0.67 | 0.87 | 0.86 | 0.86 | 0.75 | 0.45 | 0.65 | 0.56 |
| U2C11 | -1.44 | -1.23 | -1.24 | -1.24 | -1.35 | -1.65 | -1.46 | -1.54 |
| U3C11 | -1.44 | -1.23 | -1.24 | -1.24 | -1.35 | -1.65 | -1.46 | -1.54 |
| U4C11 | -0.24 | -0.03 | -0.04 | -0.04 | -0.15 | -0.45 | -0.26 | -0.34 |
| U5C11 | -0.24 | -0.03 | -0.04 | -0.04 | -0.15 | -0.45 | -0.26 | -0.34 |
| U6C11 | 0.06 | 0.27 | 0.26 | 0.26 | 0.15 | -0.15 | 0.05 | -0.04 |
| U7C11 | -1.44 | -1.23 | -1.24 | -1.24 | -1.35 | -1.65 | -1.46 | -1.54 |
| U8C11 | 0.06 | 0.27 | 0.26 | 0.26 | 0.15 | -0.15 | 0.05 | -0.04 |
| U9C11 | 0.06 | 0.27 | 0.26 | 0.26 | 0.15 | -0.15 | 0.05 | -0.04 |
| U10C11 | -1.44 | -1.23 | -1.24 | -1.24 | -1.35 | -1.65 | -1.46 | -1.54 |
| U1C12 | -1.14 | -0.93 | -0.94 | -0.94 | -1.05 | -1.35 | -1.16 | -1.24 |
| U2C12 | -0.54 | -0.33 | -0.34 | -0.34 | -0.45 | -0.75 | -0.56 | -0.64 |
| U3C12 | -1.14 | -0.93 | -0.94 | -0.94 | -1.05 | -1.35 | -1.16 | -1.24 |
| U4C12 | -0.84 | -0.63 | -0.64 | -0.64 | -0.75 | -1.05 | -0.86 | -0.94 |
| U5C12 | 0.67 | 0.87 | 0.86 | 0.86 | 0.75 | 0.45 | 0.65 | 0.56 |
| U6C12 | -2.94 | -2.73 | -2.74 | -2.74 | -2.85 | -3.15 | -2.96 | -3.04 |
| U7C12 | 0.06 | 0.27 | 0.26 | 0.26 | 0.15 | -0.15 | 0.05 | -0.04 |
| U8C12 | -0.54 | -0.33 | -0.34 | -0.34 | -0.45 | -0.75 | -0.56 | -0.64 |
| U9C12 | -0.54 | -0.33 | -0.34 | -0.34 | -0.45 | -0.75 | -0.56 | -0.64 |

changing opinion after getting evidence and respect for others' views. The negative aligned contents in the domains of knowledge, understanding and application may be considered a serious issue in curriculum planning and implementation. A through observation may be carried out with alignment on evaluation of the contents or question analysis on this pattern to check the actual alignment of the Physics content at the Higher Secondary stage. In simple words, it was found that there exists no alignment in application domain with the attitudes of learning Physics, while there was negative alignment with understanding domain and attitudes of learning physics. Positive alignment with skill domain was found. But the alignment with knowledge domain towards attitudinal elements of learning Physics at the Higher Secondary stage was found to be ambiguous.

**Table 7:** Alignment of physics curriculum with attitudinal elements on skills domain

| Content | CAE1 | CAE2 | CAE3 | CAE4 | CAE5 | CAE6 | CAE7 | CAE8 |
|---|---|---|---|---|---|---|---|---|
| U1C11 | 1.44 | 1.64 | 1.63 | 1.63 | 1.52 | 1.22 | 1.42 | 1.33 |
| U2C11 | 1.14 | 1.34 | 1.33 | 1.33 | 1.22 | 0.92 | 1.12 | 1.03 |
| U3C11 | 1.14 | 1.34 | 1.33 | 1.33 | 1.22 | 0.92 | 1.12 | 1.03 |
| U4C11 | 1.31 | 1.51 | 1.50 | 1.50 | 1.39 | 1.09 | 1.29 | 1.20 |
| U5C11 | 1.31 | 1.51 | 1.50 | 1.50 | 1.39 | 1.09 | 1.29 | 1.20 |
| U6C11 | 1.35 | 1.56 | 1.54 | 1.54 | 1.44 | 1.14 | 1.33 | 1.24 |
| U7C11 | 1.14 | 1.34 | 1.33 | 1.33 | 1.22 | 0.92 | 1.12 | 1.03 |
| U8C11 | 1.35 | 1.56 | 1.54 | 1.54 | 1.44 | 1.14 | 1.33 | 1.24 |
| U9C11 | 1.35 | 1.56 | 1.54 | 1.54 | 1.44 | 1.14 | 1.33 | 1.24 |
| U10C11 | 1.14 | 1.34 | 1.33 | 1.33 | 1.22 | 0.92 | 1.12 | 1.03 |
| U1C12 | 1.18 | 1.38 | 1.37 | 1.37 | 1.27 | 0.96 | 1.16 | 1.07 |
| U2C12 | 1.27 | 1.47 | 1.46 | 1.46 | 1.35 | 1.05 | 1.25 | 1.16 |
| U3C12 | 1.18 | 1.38 | 1.37 | 1.37 | 1.27 | 0.96 | 1.16 | 1.07 |
| U4C12 | 1.22 | 1.43 | 1.42 | 1.42 | 1.31 | 1.01 | 1.20 | 1.12 |
| U5C12 | 1.44 | 1.64 | 1.63 | 1.63 | 1.52 | 1.22 | 1.42 | 1.33 |
| U6C12 | 0.92 | 1.13 | 1.12 | 1.12 | 1.01 | 0.71 | 0.90 | 0.82 |
| U7C12 | 1.35 | 1.56 | 1.54 | 1.54 | 1.44 | 1.14 | 1.33 | 1.24 |
| U8C12 | 1.27 | 1.47 | 1.46 | 1.46 | 1.35 | 1.05 | 1.25 | 1.16 |
| U9C12 | 1.27 | 1.47 | 1.46 | 1.46 | 1.35 | 1.05 | 1.25 | 1.16 |

**Table 8:** Average alignment score of physics curriculum with attitudinal elements

| Attitudinal Elements | Knowledge | Understanding | Application | Skill |
|---|---|---|---|---|
| CAE1 | 0.09 | -1.80 | -0.65 | 1.25 |
| CAE2 | 0.30 | -1.60 | -0.44 | 1.45 |
| CAE3 | 0.29 | -1.61 | -0.45 | 1.44 |
| CAE4 | 0.29 | -1.61 | -0.45 | 1.44 |
| CAE5 | 0.18 | -1.72 | -0.56 | 1.34 |
| CAE6 | -0.12 | -2.02 | -0.86 | 1.03 |
| CAE7 | 0.07 | -1.82 | -0.67 | 1.23 |
| CAE8 | -0.02 | -1.91 | -0.75 | 1.14 |

**Table 9:** Chi-square test of observation between favourable and unfavourable score on Physics Curriculum with attitudinal elements

| Elements | U | F | Test of observation |
|---|---|---|---|
| CAE1 | 266 | 234 | $\chi^2(1)=2.048$; p=0.152>0.05; 2-tailed; Insignificant |
| CAE2 | 253 | 247 | $\chi^2(1)=0.072$; p=0.788>0.05; 2-tailed; Insignificant |
| CAE3 | 266 | 234 | $\chi^2(1)=2.048$; p=0.152>0.05; 2-tailed; Insignificant |
| CAE4 | 256 | 244 | $\chi^2(1)=0.288$; p=0.592>0.05; 2-tailed; Insignificant |
| CAE5 | 250 | 250 | $\chi^2(1)=0.000$; p=1.000>0.05; 2-tailed; Insignificant |
| CAE6 | 281 | 219 | $\chi^2(1)=7.688$; p=0.006<0.05; 2-tailed; significant |
| CAE7 | 250 | 250 | $\chi^2(1)=0.000$; p=1.000 >0.05; 2-tailed; Insignificant |
| CAE8 | 318 | 182 | $\chi^2(1)=36.992$; p=0.000<0.05; 2-tailed; significant |

U: Unfavorable and F: Favorable: - Attitude towards Physics Curriculum Alignment

# Conclusion

Alignment and attitudinal values in learning Physics were mainly tested in the present study. It was found that there was *no alignment* with application domain and attitude of learning Physics, while there was negative alignment with understanding and attitude towards learning Physics at the Secondary stage. It was also observed that Physics learning was less activity-oriented and more like literature reading with inadequate practical experience; this falls on the line of previous studies where Physics is boring which provides no problem-solving scope and negative attitude towards the subject (24, 25, 27). The present study found negative alignment on an average from understanding and application domains with attitudes of learning physics, positive alignment for skills domain and observation of significant differences in the alignment of knowledge domain. Attitudes like change of opinion after getting evidence (CAE6) and respect for others' views (CAE8) were found to be significantly different [$\chi^2(1) = 7.688$; p=0.006<0.05; $\chi^2(1) = 36.992$; p=0.000<0.05; respectively]. It is concluded that the present COHSEM syllabus of Physics for Higher Secondary stage was found to be unfavourable with the attitudes of learning physics, especially for changing opinion after getting evidence and respect for others' views. The finding is somewhat different from the previous studies where attitudes towards changes were positive and played significant role in shaping positive attitude making the subject pleasant and interesting (32, 33). The difference may be due to several factors which needs further analysis as the current sample respondents were enrolled students just after the post-covid phase. Learning climate of physics after post-covid needs proper investigation towards attitudinal changes on learning Physics and also other disciplinary studies.

## Abbreviations

Nil

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Nil

## Authors contribution

The authors confirm the contribution to the paper as follows: study conception: Thangjam Medha Devi and Aribam Dhaneshwari Devi; study design: Soibam Birajit Singh and Aribam Dhaneshwari Devi; data collection: Thangjam Medha Devi analysis and interpretation of results: Thangjam Medha Devi and Soibam Birajit Singh; manuscript preparation: Thangjam Medha Devi; Aribam Dhaneshwari Devi and Soibam Birajit Singh; and All authors reviewed the results and approved the revision of the manuscript.

## Conflicts of interest

No conflict of interest with the manuscript.

## Ethics approval

Not applicable

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# References

1. Polikoff MS, Porter AC. Instructional Alignment as a Measure of Teaching Quality. Educational Evaluation and Policy Analysis. 2014 Dec;3(4):399–416.
2. Burris VF, Owens JK. Curriculum Evaluation and Alignment of Core Ideals: Application of a Values-Based Framework. Journal of Christian Nursing [Internet]. 2023 Aug 18;10.1097/CNJ.0000000000001088. Available from: https://journals.lww.com/journalofchristiannursing/abstract/9900/curriculum_evaluation_and_alignment_of_core.14.aspx
3. Papageorgiou S, Xu X, Timpe-Laughlin V, Dugdale DM. Exploring the Alignment between a Curriculum and a Test for Young Learners of English as a Foreign Language. Research Memorandum. ETS RM-20-08 [Internet]. ERIC. 2020 [cited 2024 Jan 4]. Available from: https://eric.ed.gov/?id=ED614357
4. Wallace MP, Ke H. Examining the Content Alignment between Language Curriculum and A Language Test in China. TEFLIN Journal. 2023 Apr 11;34(1):116–6.
5. Leitzel TC, Vogler DE. Curriculum Alignment: Theory to Practice [Internet]. ED 371 812. Vol. Viewpoints (120) ED 371 812. USA: ERIC; 1994 [cited 2024 Jan 4]. Available from: https://files.eric.ed.gov/fulltext/ED371812.pdf
6. Pape-Zambito DA, Mostrom AM. Improving Teaching through Triadic Course Alignment. Journal of Microbiology & Biology Education. 2018 Oct 31;19(3). https://journals.asm.org/doi/pdf/10.1128/jmbe.v19i3.1642
7. Shaltry C. A new model for organizing curriculum alignment initiatives. Advances in Physiology Education. 2020 Dec 1;44(4):658–63. DOI: 10.1152/advan.00174.2019
8. Biggs J. Enhancing teaching through constructive alignment. Higher Education [Internet]. 1996 Oct;32(3):347–64. Available from: https://link.springer.com/article/10.1007/bf00138871
9. Jensen JL, McDaniel MA, Woodard SM, Kummer TA. Teaching to the Test…or Testing to Teach: Exams Requiring Higher Order Thinking Skills Encourage Greater Conceptual Understanding. Educational Psychology Review. 2014 Jan 16;26(2):307–29. https://doi.org/10.1007/s10648-013-9248-9
10. Michael J, Cliff W, Mcfarland J, Modell H, Wright A, Springerlink (Online Service. The Core Concepts of Physiology: A New Paradigm for Teaching Physiology. New York, Ny: Springer New York; 2017.
11. Porter AC. Measuring the Content of Instruction: Uses in Research and Practice. Educational Researcher. 2002 Oct;31(7):3 14. https://doi.org/10.3102/0013189X031007003
12. Webb NL. Criteria for Alignment of Expectations and Assessments in Mathematics and Science Education. Research Monograph No. 6 [Internet]. ERIC. Council of Chief State School Officers, Attn: Publications, One Massachusetts Avenue, NW, Ste; 1997. Available from: https://eric.ed.gov/?id=ED414305
13. Almaleh A, Aslam MA, Saeedi K, Aljohani NR. Align My Curriculum: A Framework to Bridge the Gap between Acquired University Curriculum and Required Market Skills. Sustainability. 2019 May 7;11(9):2607. https://doi.org/10.3390/su11092607
14. Qhibi AD, Dhlamini ZB, Chuene K. Investigating the strength of alignment between Senior Phase mathematics content standards and workbook activities on number patterns. Pythagoras. 2020 Dec 17;41(1). https://doi.org/10.4102/pythagoras.v41i1.569
15. Bhagwat S. Scientific Attitude Scale. Agra: National Psychological Cooperation; 2006.
16. Gakhar SC, Kaur A. Scientific Attitude Scale. Agra: Rakhi Prakashan; 2014.
17. Grewal A. Scientific Attitude Scale. Agra: National Psychological Cooperation; 2012.
18. Noll VH. Measuring the scientific attitude. The Journal of Abnormal and Social Psychology. 1935 Jul;30(2):145–54. https://doi.org/10.1037/h0059829
19. Assem HD, Nartey L, Appiah E, Aidoo JK. A Review of Students' Academic Performance in Physics: Attitude, Instructional Methods, Misconceptions and Teachers Qualification. European Journal of Education and Pedagogy. 2023 Jan 31;4(1):84–92. https://doi.org/10.24018/ejedu.2023.4.1.551
20. Kanyesigye ST, Uwamahoro J, Kemeza I. Effect of problem-based learning on students' attitude towards learning physics: a cohort study. F1000Research. 2022 Nov 1;11:1240. https://doi.org/10.12688/f1000research.125085.1
21. Yani A, Setiawan A. Interactive Lecture Demonstrations (ILD) Model to Improve Students Understanding and Attitude towards Physics. Science Education and Application Journal. 2022 Mar 15;4(1):15. https://doi.org/10.30736/seaj.v4i1.525
22. Putra DS, Irawan A, Yanto JP, Putra MM, Adli S, Dewi UP, et al. Relationship of Attitude with Student Learning Environment Toward Physics. Tarbiyah: Jurnal Ilmiah Kependidikan. 2020 Dec 15;9(2):78. https://doi.org/10.18592/tarbiyah.v9i2.3522
23. Choudhary FR, Javeed T, Zaman S. Learners and Instructors Attitude towards Physics Achievement at Secondary Level. Global Regional Review. 2019 Dec 30;IV(IV):441–9.
24. Mbonyiryivuze A, Yadav LL, Amadalo MM. Students' attitudes towards physics in Nine Years Basic Education in Rwanda. International Journal of Evaluation and Research in Education (IJERE). 2021 Jun 1;10(2):648. http://doi.org/10.11591/ijere.v10i2.21173
25. Mabee MKA, Haruna TZ, Salifu A. Attitude of Students Towards the Study of Physics: A Case of Tamale College of Education, Ghana. Journal of Education and Learning Technology. 2021 Jun 25;10–6. https://doi.org/10.38159/jelt.2021212
26. Cermik H, Kara I. Physics Course Attitudes Scale for High School Students: A Validity and Reliability Study. International Journal of Assessment Tools in Education. 2020 Feb 23;62–72. https://dx.doi.org/10.21449/ijate.693211

27. Guido RM. Attitude and Motivation towards Learning Physics. International Journal of Engineering Research & Technology (IJERT). 2013 Nov;2(11):2087–93.
28. Kurniawan DA, Astalini A, Sari DK. An evaluation analysis of students' attitude towards physics learning at senior high school. Jurnal Penelitian dan Evaluasi Pendidikan. 2019 Jun 29;23(1):26–35. http://dx.doi.org/10.21831/pep.v23i1.20821
29. Astalini A, Maison M, Kurniawan DA, Yuniyarsih S. Students attitude of physics lesson in senior high school. Edusains. 2018 Jun 13;10(1). https://doi.org/10.15408/es.v10i1.7214
30. Baquete A, Mutimucuio I, Grayson D. Effect of indigenous knowledge in a physics curriculum on pupils' attitudes towards physics. Scientific Rev. EMU:
Ser. science. education. [Internet]. October 18, 2020 [cited January 4, 2024];1(2). Available at: https://www.revistacientifica.uem.mz/revista/index.php/edu/article/view/85
31. Veloo A, Nor R, Khalid R. Attitude towards Physics and Additional Mathematics Achievement towards Physics Achievement. International Education Studies. 2015 Feb 25;8(3). https://doi.org/10.5539/ies.v8n3p35
32. Balta N, Eryılmaz A. Turkish New High School Physics Curriculum: Teachers' Views and Needs. Int J Phys & Chem Ed [Internet]. 2011 Jan. 12 [cited 2024 Jan. 4];3(SI):72-88. Available from: https://www.ijpce.org/index.php/IJPCE/article/view/109
33. Stefan M, Ciomos F. The 8th and 9th Grades Students' Attitude towards teaching and learning physics. Acta Didactica Napocensia. 2010;3(3):7–14.