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Hau-Kashyap approach for student's level of expertise

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ABSTRACT

The recent reviews indicated learning expertise level could be enhanced with skills, creativity and preferences. This stage should be taken at the first stage combined highly with providing the framework in underlying the learning expertise. This paper attempts to propose the model of Hau-Kashyap used to describe in yielding the robust results to measure the learning expertise level. This approach was selected to give an insight with a more accurate by examining twelve items of questionnaire applied among the students at tertiary level to explore the representation of wide range of knowledge and skills. The results found that the stage level of belief that ranges combined from the level of expertise 1–12 was indicated that Hau-Kashyap approach can be determined to measure the learners' expertise more fairly and easily. This method is supposed to contribute providing the purposeful rule in combining the learning expertise constructed into a single and more informative hint with related concern of the measurement.
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1. Introduction

The indication to be measured to achieve the learning expertise can be viewed from cultural identity in learning, learning styles with cognitive basis, learning preferences, and creativity skills where this might be entirely enhanced to give insights on any subject matter [1,2]. Being completely undertaken along with the indication mentioned earlier, it becomes pivotal to recognise the way in determining the expertise concern. Along with the work on carrying out determining the learning expertise, some can be viewed using wide range of approach including clinical experiment [3], technology cognition [4], psychometric statistical tests [5], and decision theory [6]. Since all these works have been elucidated with the lack of robustness once conflicting evidence combined highly with providing the framework in underlying the learning

expertise, the work presented here in this paper aims to propose the model of Hau-Kashyap that will be described to yield robust results in the sense to measure subject matter expertise. This approach was chosen in giving a more accurate through identifying the level of expertise with related concern of the measurement. Subsequent stage will begin with first presenting the literature review in addressing the wide range of approaches determined to measure the subject matter with the expertise level. The next step will be focusing on the attempts to describe the research to be employed using data analysis, discussion of results, and ends with the conclusion.

2. Hau-Kashyap approach and Dempster model development

The model of Hau-Kashyap (HK) refers to provide an initiative solution once conflicting evidence through giving assignments with a more intuitive joint mass incorporated with belief values. As applied in conflicting the evidence together with increasing the conflict, the plausibility value from Dempster's rule would yield the range of large belief incorporated with plausibility range [7]. In the attempts to artificially imply with a complementary initiative to fulfil once the lack of knowledge in focal elements, HK approach might be the alternative way to enhance the positive result obtained from the development model of Dempster-Shafer's

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rule. In particular side, addressing an alternative approach can be viewed from the mass associated with conflict [8]. The entire set of the universe is initially assigned to the union of the sets where the scale of its intersection looks empty. The combination of Dempster's rule assigned with HK is determined to have an insightful value to underlie the theoretical development rule which eventually exists to the simplicity of the data [9]. With giving more criticisms, HK method is assigned to fulfil the problem by correcting it from the Dempster's rule with possessing the attempt to encounter the application of Shafer's belief function approach. This approach in managing the uncertainty refers to give insights into reasoning the rule-based systems in the way which can be viewed as an inference network to value uncertainty the belief of hypotheses in the aggregation from different sources. Among uncertain information, there are three types of aggregation of belief including belief conjunction, belief combination, and belief propagation [7].

In addition, the particular side between belief combination and belief propagation can be viewed from the way of encountering the particular situation known as operation of belief conjunction. Cooperating with other beliefs consisting of belief conjunction and conflict resolution strategy, belief combination in the process of normalizing strategy of the conflict resolution adopted into process in underlying the belief combination procedure [7]. In this view, it will yield the particular results which can be identified through Dempster's rule once the independent result was found as evidence. Considered to combine with highly conflicting evidence, an alternative initiative to encounter the conflict resolution not robust as the strategy in seeking for compromising to remedy this deficiency among belief functions is needed to possess the value of resulting in the belief propagation upon the interpretation of the rule within an interpolative procedure. Dependent of the different interpretations along with the rules, procedural stage of giving insights into the proposed belief propagation is to be shown with chaining syllogism in attempting to go through the interpretation. Being investigated to possibly interpret the rules in terms of inference consolidated within the lattice-structured inference network [10], an equivalent inference network with the logical approach is contemplated with involving the combination of independent knowledge sources within the interpolative approach [11]. Discussed along with an inference network assigned into the logical approach, the initiative of interpolative approach is needed to expand the complexity of computing Dempster-Shafer's belief function approach. Through explicating the proposed belief function approach referring to the functions in dichotomous belief basis in representing the particular view including facts and rules, the scheme with being more general within its implication on the complexity might have look at the facts and rules in the belief conjunction.

In further, the combination of Dempster's rule can be seen from the Dempster's rule of non-robust once associating with the evidence along with enlarging the high conflict degree. As a result of giving insights into alternative strategy for conflict resolution in this particular way, it is important to note in providing the initial value for making remedy in the sense which address the deficiency. Occasionally with the beneficial value to encounter the contrast view proposed to the conflict resolution strategy of Dempster's rule, this approach was determined in looking for the consensus basis in enabling the consolidation among belief functions [8,9]. Moreover, proposed conflict resolution strategy may have a look at seeking the potential enhancement to consistently compromise among belief functions. As a result of proofing the proposed conflict resolution strategy, belief propagation in attempting to yield the conjunction of the beliefs with more intuitive appealing results needs to have a link between the fact and the rule shown to be an interpolation between total ignorance and the uncertainty [7]. The result of belief propagation here refers to the rule of the

interpretations depending on the way of interpreting the rule itself to yield the procedure of rules associative belief propagation. It indicated to have channel in connecting the interpretation of procedure concisely enhanced with the corresponding chaining syllogism where the belief propagation procedure is derived in the sense which might apply throughout the proposed inference procedures. This can also be enlarged with employing the lattice-structured inference network. The fundamental distinction between the Dempster-Shafer combination rule and the Hau-Kashyap combination rule is that with the use of Hau-Kashyap rule the combination conflict is put into the union.

3. Learning expertise

As the process of acquiring information derived from the process of new or modifying existing knowledge, behaviours, skills, values, or preferences, the enhancement process would derive from the wide ranges of approach including technology in education. In order to support the learning with necessary process in strengthening the ability among the users assigned into the counselling service initiative, it is necessary to enlarge the learning enhancement [10–12] in the sense which addresses the therapy skills approaching the engagement of technology with considering awareness of adaptive care enhancement [13,14]. In particular, adaptive behaviour in underlying the teaching competencies referring to the advancement of technology development assigned to provide an insightful contribution to the education should combine with sustainable integrity on the learning with maintaining the expertise level [15,16]. Moreover, the subsequent step with resulting in this learning approach with wise approach engaged into the sustainability is entirely considered to give insights into promoting stage among knowledge, thinking and skills. Attempts to provide the particular stability in assisting to enhance the responsibility awareness together with maintaining the conducive circumstances provided in the learning may also incorporate service learning referring to the compassionate-based innovative approach [17–19]. In particular, this initiative should bring along with taking into account strengthening the moral basis in the efforts to commit wisely in attempting to enhance the interaction in the digital era [20,21]. In particular, an innovative approach combined into the analytics basis in underlying the learning process should be engaged in improving the personalised capacity cooperated with the technology [22]. In this view, enhancing the comprehensive learning process is engaged to commit to the achievement scale [23]. As a result of giving insights into evaluating the quality of learning, the appropriate combination between innovative teaching [12,13] and comprehensive learning is required to the attempt for the academic empowerment carried out in solving the problem. Referring to support the learning enhancement [24,25], it is necessary to see the particular value in emphasising the management of self-empowerment with an entire basis to take over in handling the academic problems [26–29]. In order to strengthen this initiative, it is required to employ the diagnostic analysis applied in this case to enhance the academic achievement which may be employed through the learning expertise referring to Hau-Kashyap Approach.

4. Between expertise and expert on learning enhancement

In order for being expert in learning, the strength to consistently work within the scale planned in engaging into the behavioural substance should bring along with reaching the expert level. Through precise timeframe assigned to develop the expertise level, some effort in employing necessary stages should be enlarged with addressing the practical stability. In this view,

being more aware of enhancing the learning expertise is entirely a good chance to improve the skill expertise through some real applicability work [30]. This initiative refers to enhance in maximising the potential value along with addressing the type of practice to make more experiential in terms of getting experiment [31]. In particular side, enhancing the typical ideas assigned to develop skills such as solving the error or trouble needs to prepare with planning in determining the appropriate way to apply for the learning enhancement in order to reach the expertise level. The expertise level should broaden the knowledge understanding about the particular issues to help provide the solving initiation with creativity. Moreover, attempts to help develop the learning enhancement through bringing together with planning, acting and evaluating such stages of learning process itself [32,33]. Along with such initiatives, attempts to look at examples in the cognitive basis should be combined with improving the learning in the sense which focuses on worked examples [34]. Achieving this case with a completed module to enable the interaction basis, attempts to get the beneficial value from the learning enhancement would be considered in particular way in the effort to yield the curious enlargement in enabling to connect with others. This tendency needs to possess the learning with knowledge understanding deriving from such experiential basis in assuring to connect with a diverse range of good places in connecting with the wider community. In terms of expertise and being expert in the learning enhancement, such components should be taken into account in enabling the digital tool platform like the one in social media in making possible to connect with others locally and globally throughout the world [35,36]. With being experienced, reflection on such activities assigned into the learning enhancement process is necessary to consent in incorporating the knowledge skills to be applied along with the daily life. It gives to enlarge the potential value of reflecting on and embedding into the reality-based every day practice. In term of the extensive orientation of empowering application strategy, learning enhancement could be managed widely into the technology adoption referring to commit professional and ethical engagement [37]. In terms of learning integration through utilising the technology attribution through autograph [38], the attempts to improve leaning achievement in enabling the students' overall ability to manage in particular basis should be integrated into the area and volume in learning with the additional value in order to successfully construct the assessment process and display the criteria of identification process to reach the purpose along with developing entrance examination procedure stage where the learners would have obtain.

5. Implementation and analysis

Questionnaire was used to collect data on the students' perception of their level of expertise related to knowledge and skills. For details of the items and acronym used to represent the skills (for example W is for writing, etc.) in the questionnaire, please refer to Appendix A. The students' responses were analyzed using Hau-Kashyap approach where a rating of 0 to 10 was assigned to represent the degree of belief. The m_i refers to the students' degree of belief where i = 1, 2, 3, ..., 12 refers to the items in the questionnaire. The students' response to the questionnaire is as shown in Appendix B. The level of expertise calculation process is as follows: for example from question number 12, what is your level of understanding of the marketing mix? As an illustration, consider question/items 12 in the questionnaire. This question indicates that student has marketing skills (M), m_{12} {M} = 0.7. Table 1 below shows the calculation for the combination $m_{11} \oplus m_{12}$ for level of expertise 11 and level of expertise 12.

From table 1 we get:

{W,NA,ICT,M} = 0.653 + 0.28 + 0.006 = 0.939, {W,NA,ICT} = 0.003, {W,NA,M} = 0.008 + 0.003 + 0.0001 = 0.0111, {W,NA} = 0.00003, {W,ICT,M} = 0.003 + 0.0015 + 0.00003 = 0.00453, {W,ICT} = 0.000015, {W,M} = 0.00007 + 0.00003 + 0.0000007 = 0.0001007, {W} = 0.0000003, {NA,ICT,M} = 0.028 + 0.012 + 0.0003 = 0.0403, {NA,ICT} = 0.0001, {NA,M} = 0.0003 + 0.0001 + 0.000003 = 0.000403, {NA} = 0.000001, {ICT,M} = 0.0002 + 0.00007 + 0.000001 = 0.000271, {ICT} = 0.000001, {M} = 0.000034 + 0.00001 + 0.00000003 = 0.00004403, {Θ} = 0.00000001

The final ranking of degree of belief was found to be W,NA,ICT,M > W,NA,ICT < W,NA,M > W,NA < W,ICT,M > W,ICT < W,M > W < NA,ICT,M > NA,ICT < NA,M > NA < ICT,M > ICT < M.

6. Results and discussion

Hau-Kashyap approach has been applied to student's level of expertise. Level of expertise diagnostic is presented in Fig. 1. Level of expertise include writing style, numeracy and accounting skills, information and communications technology, and marketing. Based on the calculation, the level of expertise was found namely writing style 0.00003%, numeracy and accounting skills 0.0001%, information and communications technology 0.0001%, and marketing 0.004403%.

Table 2 shows student's level of expertise rank. According to the Hau-Kashyap approach the combination conflict is put into the

Table 1
Combining level of expertise 11 and 12.

| Level of expertise	Degree of belief	M	0.7	θ	0.3
W,NA,ICT,M	0.933	W,NA,ICT,M	0.653	W,NA,ICT,M	0.28
W,NA,ICT	0.009	W,NA,ICT,M	0.006	W,NA,ICT	0.003
W,NA,M	0.011	W,NA,M	0.008	W,NA,M	0.003
W,NA	0.0001	W,NA,M	0.0001	W,NA	0.00003
W,ICT,M	0.005	W,ICT,M	0.003	W,ICT,M	0.0015
W,ICT	0.00005	W,ICT,M	0.00003	W,ICT	0.000015
W,M	0.0001	W,M	0.00007	W,M	0.00003
W	0.000001	W,M	0.0000007	W	0.0000003
NA,ICT,M	0.04	NA,ICT,M	0.028	NA,ICT,M	0.012
NA,ICT	0.0004	NA,ICT,M	0.0003	NA,ICT	0.0001
NA,M	0.0005	NA,M	0.0003	NA,M	0.0001
NA	0.000004	NA,M	0.000003	NA	0.000001
ICT,M	0.00024	ICT,M	0.0002	ICT,M	0.00007
ICT	0.000002	ICT,M	0.000001	ICT	0.000001
M	0.000048	M	0.000034	M	0.00001
θ	0.00000004	M	0.00000003	θ	0.00000001
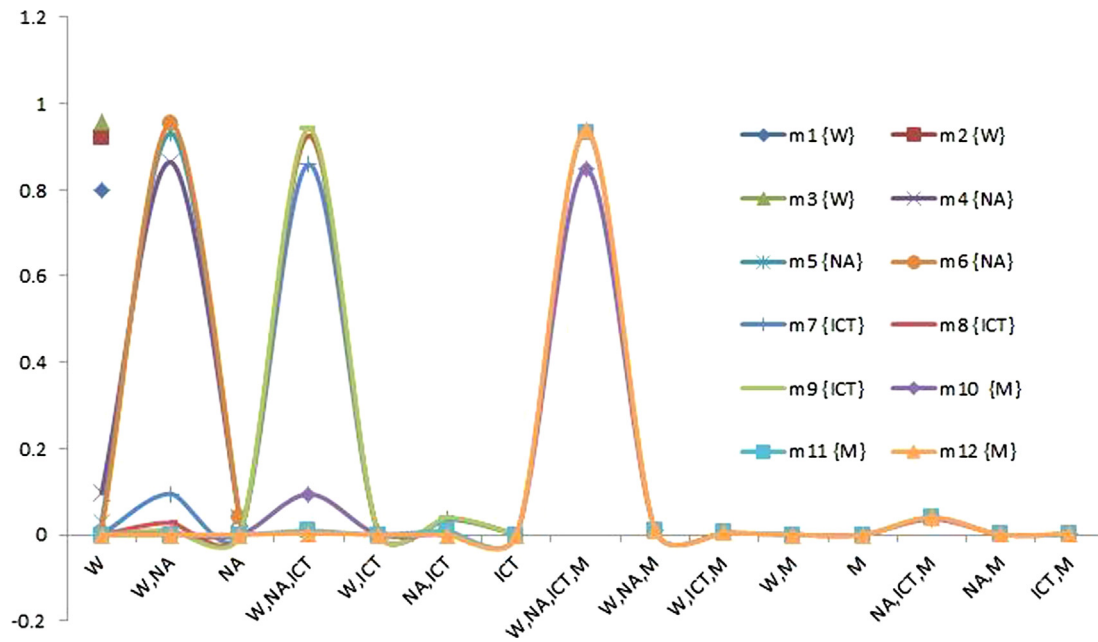
Fig. 1. Student's level of expertise diagnostic process.

Table 2
Student's level of expertise rank.

No.	W	Op	W, NA	Op	NA	Op	W,NA,ICT	Op	W,ICT	Op	NA,ICT	Op	ICT	Op	W,NA,ICT,M
1	0.8	>	null	=	null	=	null	=	null	=	null	=	null	=	null
2	0.92	>	null	=	null	=	null	=	null	=	null	=	null	=	null
3	0.96	>	null	=	null	=	null	=	null	=	null	=	null	=	null
4	0.096	<	0.864	>	0.036	>	null	=	null	=	null	=	null	=	null
5	0.029	<	0.931	>	0.039	>	null	=	null	=	null	=	null	=	null
6	0.006	<	0.954	>	0.04	>	null	=	null	=	null	=	null	=	null
7	0.001	<	0.095	>	0.004	<	0.859	>	0.005	<	0.036	>	0.00002	>	null
8	0.0003	<	0.028	>	0.001	<	0.9253	>	0.005	<	0.039	>	0.0002	>	null
9	0.0001	<	0.011	>	0.0004	<	0.942	>	0.0051	<	0.04	>	0.00021	>	null
10	0.00001	<	0.001	>	0.00004	<	0.094	>	0.0005	<	0.004	>	0.00002	<	0.848
11	0.000001	<	0.0001	>	0.000004	<	0.009	>	0.00005	<	0.009	>	0.000002	<	0.933
12	0.0000001	<	0.00003	>	0.000001	<	0.003	>	0.000015	<	0.0001	>	0.000001	<	0.939

No.	Op	W,NA,M	Op	W,ICT,M	Op	W,M	Op	M	Op	NA,ICT,M	Op	NA,M	Op	ICT,M
1	=	null	=	null	=	null	=	null	=	null	=	null	=	null
2	=	null	=	null	=	null	=	null	=	null	=	null	=	null
3	=	null	=	null	=	null	=	null	=	null	=	null	=	null
4	=	null	=	null	=	null	=	null	=	null	=	null	=	null
5	=	null	=	null	=	null	=	null	=	null	=	null	=	null
6	=	null	=	null	=	null	=	null	=	null	=	null	=	null
7	=	null	=	null	=	null	=	null	=	null	=	null	=	null
8	=	null	=	null	=	null	=	null	=	null	=	null	=	null
9	=	null	=	null	=	null	=	null	=	null	=	null	=	null
10	>	0.01	>	0.005	>	0.0001	>	0.00004	<	0.036	>	0.0004	>	0.0002
11	>	0.011	>	0.005	>	0.0001	>	0.000048	<	0.04	>	0.0005	>	0.00024
12	>	0.011	>	0.004	>	0.0001007	>	0.0000403	<	0.04	>	0.0004	>	0.003

union namely {W,NA,ICT,M} = 0.939, {W,NA,ICT} = 0.003, {W,NA, M} = 0.0111, {W,NA} = 0.00003, {W,ICT,M} = 0.00453, {W,ICT} = 0.000015, {W,M} = 0.0001007, {NA,ICT,M} = 0.0403, {NA,ICT} = 0.0001, {NA,M} = 0.000403, {ICT,M} = 0.000271. From the last calculation we get the final ranking of degree of belief is writing style {W} < numeracy and accounting skills {NA} = information and communications technology {ICT} < marketing {M}. Thus, the proposed Hau-Kashyap approach obtained robust combination method.

7. Conclusion

This paper did elaborate in examining the learning expertise using Hau-Kashyap approach in order to achieve the measurement process more easily and fairly. The recent indication on learning expertise showed that some components like skills, creativity and preferences play a key role in enhancing the stage level of expertise. With providing the framework in underlying the learning expertise, this enhancement process could be carried out at the early stage. Through the model of Hau-Kashyap used to

describe in yielding the robust results to measure the learning expertise level, this approach was selected to give an insight with a more accurate by examining twelve items of questionnaire applied among the students at tertiary level to explore the representation of wide range of knowledge and skills. The results found that the stage level of belief that ranges combined from the level of expertise 1–12 was indicated that Hau-Kashyap approach can be determined to measure the learners' expertise more fairly and easily. This method is supposed to contribute providing the purposeful rule in combining the learning expertise constructed into a single and more informative hint with related concern of the measurement. Identifying the student's level of expertise would provide the purposeful guideline in combining the expertise together with knowledge and skills among the students into a single and more informative hint. Thus, the level of Marketing was indicated to be the one with high expertise level. In particular, the one with good grasp of knowledge and skills would give feedback with the potential method to evaluate level of expertise.

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Appendix A

Questionnaire on knowledge and skills of student expertise

No.	Questions	Student expertise
1	How do you feel about your writing ability for undertaking university studies?	Writing Style {W}
2	Do you feel your writing ability comes easily or do you feel it is difficult process?	Writing Style {W}
3	What are your feelings about your own writing style?	Writing Style {W}
4	How do you feel about your maths skills?	Numeracy and Accounting Skills {NA}
5	How do you feel about your ability to do accounting (e.g. sales and purchase related skills)?	Numeracy and Accounting Skills {NA}
6	Do you feel your maths abilities come easily or do you feel this is a difficult process?	Numeracy and Accounting Skills {NA}
7	How do you feel about using computers for completing assignments	Information and Communications Technology {ICT}
8	How do you feel about your typing abilities?	Information and Communications Technology {ICT}
9	How do you rate your level of Internet skills?	Information and Communications Technology {ICT}
10	How do you feel about marketing a product or service?	Marketing {M}
11	What level of confidence do you feel in being able to sell, directly or indirectly?	Marketing {M}
12	What is your level of understanding of the marketing mix?	Marketing {M}

Appendix B

Perception on knowledge and skills of student expertise

No.	Questions	Answer	Degree of belief
	Writing Style {W}		
1	How do you feel about your writing ability for undertaking university studies?	7	0.7
2	Do you feel your writing ability comes easily or do you feel it is difficult process?	5	0.5
3	What are your feelings about your own writing style?	4	0.4
	Numeracy and Accounting Skills {NA}		
4	How do you feel about your maths skills?	8	0.8
5	How do you feel about your ability to do accounting (e.g. sales and purchase related skills)?	6	0.6
6	Do you feel your maths abilities come easily or do you feel this is a difficult process?	7	0.7
	Information and Communications Technology {ICT}		
7	How do you feel about using computers for completing assignments	9	0.9
8	How do you feel about your typing abilities?	6	0.6
9	How do you rate your level of Internet skills?	5	0.5
	Marketing {M}		
10	How do you feel about marketing a product or service?	8	0.8
11	What level of confidence do you feel in being able to sell, directly or indirectly?	9	0.9
12	What is your level of understanding of the marketing mix?	6	0.6

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