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Learning perceptions of medical students engaged in clinical teaching postings in neonatal intensive care units

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Abstract

We are reporting the results of implementing Learning from Observation and Discussions at Clinical Campus International Medical University, Kuala Lumpur, Neonatal Intensive Care Unit (NICU). This initiative was conceived and successfully implemented with the aim to identify medical students' learning perception from self-reported learning experiences. A total of 80 semester eight medical students were invited to participate in the study. A structured, validated and reliable instrument developed from a work skill development framework was used to assess students' perception of learning through discussions and observations (Total D&O), input from their experience providing future ideas (Total Ideas) and guided ward rounds as a new learning format (Total Visit). Informed consent was obtained from 42 students who participated over the ten-month period of the study. Data was analysed with ANOVA and structural regression equation modelling. The study showed that both Total Visit and Total Discussion & Observation can predict Total Perception of Learning. According to student evaluations, the Total Visits rating was the best single predictor summarising positive perception of rounds at the neonatal intensive care unit based on the significance values, partial eta squared and power. Students ranked the process of guided rounds at the neonatal intensive care unit as valuable in providing educational experiences and integral to their learning perception.

Keywords: *Perception of Learning, Bedside Teaching, Clinical Neonatology, Observational Learning*

Practice Highlights

- The study seeks to test whether observational learning by medical students can predict a student's perception of learning at NICUs.
- Students benefit and learn from active and purposeful NICU rounds supervised by a neonatologist.
- Total Visits rating was the best single predictor of a positive perception of NICU rounds based on the significance values, partial Eta squared and power.
- The study supports the adoption of observation-based learning exercises to augment the traditional case presentations in medical student training.

I. INTRODUCTION

Despite a decline in practice, bedside teaching (BST) remains an important component of education for students of medicine and other health professions in helping to develop knowledge, skills and attitudes (Peters & Ten Cate, 2014; Stickrath et al., 2013). BST can be adapted to various clinical departments including the neonatal intensive care unit (NICU). Approved learning outcomes for fourth-year medical students rotating at the Special Care Nursery (SCN) involve demonstration of medical knowledge, comprehension of pathophysiology and formulating management plans.

Although it is widely accepted that medical students benefit and learn from active and purposeful NICU rounds, there is little prospect of learning proficiently without guidance and a purposeful curriculum (Biggs & Tang, 2011). Some teaching hospitals even restrict access to NICUs for medical students due to the risk of infections or possible conflicts of interest with other health professionals and parents. Hence, students are

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more likely to refer to ward rounds at the SCN where clinically stable infants may need feeding training, rooming-in, phototherapy or antibiotics, and are usually expected to be discharged within a few days or weeks. In contrast, NICUs are designed for newborns in need of specialised, high-tech medical and nursing care, including respiratory support. The unit provides care for the most complex conditions in the neonatal period, and may also include surgical care and transport of critically ill newborn infants. The NICU experience of medical students includes observational learning, sharing of knowledge, good practice, and identifying ethical issues. However, patients in the SCN and NICU are difficult to enlist for autonomous and self-directed learning. It is evident that clinical teaching in the NICU where hands-on practice is limited, and multiple learning models co-exist, includes understanding, application, critical, thinking, creativity and communication in addition to formal learning (Bannister, Hilliard, Regehr & Lingard, 2003). The clinical teacher, therefore, performs a key and highly demanding role in ensuring that learning outcomes are met.

A patient near learning perception of bedside teaching and demonstration in the NICU is rarely examined. We, therefore, looked at policy interventions that could improve education quality and student learning in an upper-middle-income country. We asked the question: 'How does a guided NICU round impact medical students' perception of learning neonatology?' The hypothesis (H^1) was, there is a significant relationship between Total Perception of Learning with a) discussions based on immediate observations (Total D&O), b) a student´s future ideas based on the bedside experience (Total Ideas) and c) the NICU round as a new format of observational learning (Total Visit). The H^0 was there is no significant relationship between Total Perception of Learning with Total D&O, Total Ideas and Total Visit.

II. METHODS

A. Study Design and Setting

The study was conducted as part of a programme evaluation in neonatal postings at the International Medical University (IMU), Clinical Campus, Seremban, Malaysia. Fourth-year medical students engage in an eight-week rotation in paediatric medicine. The programme features a one week posting in neonatal medicine which includes a facilitator guided NICU round. Groups of 5 or 6 students assess patients through observation and discussions with the facilitator. The students do not interact with visiting parents or get too close to procedures performed by ward staff. Patient records are available at the bedside to provide specific information for the discussion. After a briefing, students are introduced to a selection of NICU patients e.g. newborn infants with problems associated with extreme prematurity (GA 24-26 weeks), extremely low birth weight (< 1000g), respiratory distress syndrome, sepsis, persistent pulmonary hypertension of the newborn, asphyxia or congenital malformations. The rounds end with a reflection and debrief session. The total time spent for the NICU bedside teaching was 70 minutes. The single facilitator endeavour (an experienced neonatologist with competence in health professions education) throughout the NICU rounds for all groups ensured internal standardisation and accountability of teaching and instruction for all participating students.

B. Survey of Student Learning Perception

Respondents completed a consent statement outlining data transfer practices, privacy practices, and other relevant policies at the university before being allowed to take part in the survey. This study received institutional review board (IRB) exemption. Institutional agreement to conduct the study was obtained as part of the ongoing course evaluation and improvement programme.

On conclusion of the NICU teaching round students were invited to respond to an online questionnaire (Survey Monkey) covering a) how they perceived learning during NICU rounds, b) how discussions and observations supported their learning in neonatology, and c) what future perspectives they were reflecting on d) the NICU visit as a supplementary learning activity. The survey was based on a Work Skill Development Framework (Bandaranaike & Willison, 2010). Key themes of the framework are clinical education, clinical decision-making, role modelling, student presentations, establishment of trainee autonomy, and providing a safe learning environment. Items were related to the following domains: facilitate an understanding of a NICU round, resource utilisation, planning and management, life-long learning, problem-solving, critical thinking and applied communication skills in the NICU. The themes of perceived learning during NICU rounds was made up of 3 items that encompass comments related to students' exposure, facilitation and students' anxiety. The 3 items of student learning include knowledge and understanding, student-staff relationship and thinking positively. Learning from Discussions and Observation address rules and responsibilities, care of very low birth weight infants, ethics and teamwork. Improving staff relationship, communication with parents and staff and family involvement makes up the themes of possible impact on future ideas.

Students' autonomy level reached from 'highly guided' where expectations are explained to 'higher levels' of

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student self-determination. To predict possible future use of understanding and learning there was a cognitive focus to the learning domain (social, emotional and cultural intelligence).

The format of a typical five-level Likert item was applied. Items were validated within the domains, and a Cronbach alpha score of 0.89 confirmed the internal consistency of the questionnaire. Mean values and standard deviations were calculated from the response data.

C. Data Analysis

Correlation between Total Perception of learning with a) Total D&O, b) Total Ideas) and c) Total Visit was performed by applying the Pearson test (Table 1). A score > 0.8 indicated that the dimensions are measuring similar concepts. Conversely, low scores were associated with concepts that were distinct from one another.

Analysis of Variance (ANOVA) and regression analysis were used to analyse the impact of the Total D&O, Total Ideas and Total Visits on Total Perception of Learning. A significant impact was indicated by an F-ratio higher than the critical value and a significance value < 0.05. The relationship between Total Perception of Learning and the three predictors was analysed using coefficients. Beta values achieved via regression analysis tested whether the predictors have a positive impact on Total Perception, and how the model significantly predicts the outcome using the regression equation. In order to ensure that the variables are sufficiently independent of each other, collinearity measures were tested to estimate the degree of redundancy using the Tolerance and Variance Inflation Factor (VIF) values for determining multicollinearity (Table 3). The observed power indicated the reliability and accuracy of results.

The medical students taking part in the survey also provided open written comments to evaluate the learning environment and the guidance received from the clinical teachers. These comments were used to support the findings obtained from the quantitative analyses.

III. RESULTS

A total of 42 students out of 80 responded over a period of ten months.

Table 1 shows the correlation between the variables studied in this research. Scores above 0.8 denote a strong relationship between the variables. Similarly, low scores indicate that the variables have smaller effects on one another.

Table 2 shows the results of the ANOVA test. The F-ratio value indicates the extent to which the predictors (Total D&O, Total Ideas and Total Visit) impact on the dependent variable (Total Perception of Learning). The significance value < .001 shown in Table 2, is presented below. The significance value should be < 0.05 for the model of regression which is shown in Table 3. ANOVA is used to measure significant differences between the means of two groups of data. Ideally, a large F-ratio value and a significance value < 0.05 is sought for the model of regression to be valid. The results in Table 2 indicate a significant impact of the Total D&O, Total Ideas and Total Visits on a student's Total Perception of Learning with F-ratio = 58.3 and Sig < .001 confirming the above.

		Correlations			
		Total Perception[b]	**Total Visit[a]**	**Total D and O[a]**	**Total Ideas[a]**
Pearson Correlation	Total Perception	1.000	0.890	0.813	0.696
	Total Visit	0.890	1.000	0.798	0.779
	Total D and O	0.813	0.798	1.000	0.694
	Total Ideas	0.696	0.779	0.694	1.000
Sig. (1-tailed)	Total Perception	.	.000	.000	.000
	Total Visit	.000	.	.000	.000
	Total D and O	.000	.000	.	.000
	Total Ideas	.000	.000	.000	.
N	Total Perception	42	42	42	42
	Total Visit	42	42	42	42
	Total D and O	42	42	42	42
	Total Ideas	42	42	42	42

Note: a. Predictors: (Constant)
Total D and O (discussions based on immediate observations)
Total Ideas (a student´s future ideas based on the bedside experience)
Total Visit (the NICU round as a new format of observational learning)

b. Dependent Variable: Total Perception of Learning

Table 1. Correlational statistics between Total Perception, Total Visit, Total D and O and Total Ideas

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ANOVA[b]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	612.8	3	204.3	58.3	< .001[a]
	Residual	133.1	38	3.5		
	Total	745.90	41			

Note: Model 1 measures the overall difference between the data and the values predicted by the estimation model. The residual is the measure of the distance from the data point to the regression line.
a. Predictors: (Constant)
Total D and O (discussions based on immediate observations)
Total Ideas (a student´s future ideas based on the bedside experience)
Total Visit (the NICU round as a new format of observational learning)
b. Dependent Variable: Total Perception of Learning

Table 2. ANOVA table

Coefficients[a]								
Model		**Unstandardised Coefficients**		**Standardised Coefficients**			**Collinearity Statistics**	
		B	**Std. Error**	**Beta**	**t**	**Sig.**	**Tolerance**	**VIF**
1	(Constant)	7.485	1.974		3.791	.001		
	Total Visit	1.083	.208	0.693	5.202	.000	.265	3.779
	Total D and O	.493	.195	.292	2.523	.016	.350	2.860
	Total Ideas	-.086	.203	-.047	-.423	.675	.379	2.641

Note: a. Dependent Variable: Total Perception of Learning

Table 3. Table of coefficients of the regression model

Table 3 shows the results obtained after applying the regression analysis, representing the respective coefficients. The beta values provide a measure of the contribution of each dimension to the model. The B values indicate the relationship between Total Perception of Learning and the three predictors (Total D&O, Total Ideas and Total Visit). They are used to generate the unstandardised equation of the line of best fit (Equation 1) which represents the degree to which each independent variable contributes to predicting the Total Perception of Learning.

Y (Total Perception) = 7.485 + 1.083 (Total Visit) + 0.493 (Total D and O) - 0.086 (Total Ideas)

Equation 1. Unstandardised equation of the line of best fit

The equation indicates that Total Visit (the NICU round as a new format of observational learning) makes the greatest contribution to the Total Perception of Learning. There was no significant evidence to favour the contribution of Total Ideas on Total Perception of Learning.

Inspection of the values for 't' in Table 3, the highest t-value is related to Total Visit which conforms the results shown by the line of best-fit equation. Collinearity statistics refer to the degree of overlap between the dimensions being measured (redundancy). The Tolerance value and VIF values show no multi-collinearity which tends to confirm the absence of a relationship between the independent variables selected in this study.

Variable	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**	**Noncent. Parameter**	**Observed Power[b]**
Corrected Model	727.030[a]	31	23.453	12.425	.000	0.975	385.181	1.000
Intercept	22911.466	1	22911.466	12138.525	.000	0.999	12138.525	1.000
Total Visit	85.014	7	12.145	6.434	.005	0.818	45.040	0.963
Total D and O	48.510	5	9.702	5.140	.014	0.720	25.701	0.868
Total Ideas	24.047	7	3.435	1.820	.188	0.560	12.740	.441
Error	18.875	10	1.888					
Total	43626.000	42						
Corrected Total	745.905	41						

Note: Dependent Variable - Total Perception of Learning
a. R Squared = 0.975 (Adjusted R Squared = 0.896)
b. Computed using alpha = .05

Table 4. ANOVA tests between-subjects effect

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The results presented in Table 4 show the observed power for the Total Visit variable is 0.963. The values are reliable and the significance value is 0.005. Hence, the impact of Total Visit on the Total Perception of Learning is highly significant at the 95% confidence level. The observed power for Total Discussion and Observation and Total Ideas are 0.868 (reliable) and 0.441 (moderately reliable) respectively. The significance value, for Total Discussion and Observation, was 0.014, however, the value for Total Ideas (0.188) indicates that the latter factor is not a significant predictor of Total Perception of Learning among the students.

The partial Eta squared values, (Total Visit 0.818, Total Discussion & Observation 0.720) indicate that Total Visit has a higher effect and is a more statistically significant predictor of Total Perception of Learning compared to Total Discussion and Observation.

IV. DISCUSSION

Learning is a change in behaviour, skills and knowledge due to experience. Observational learning should include visual, auditory, verbal and kinaesthetic experiences to enable students to experience learning across different modalities. The present study analysed the process of learning by investigating student perception of learning (Total Perception) gained through discussion and observation (Total D&O), the student´s thoughts on future application of knowledge (Total Ideas) and their NICU round experience (Total Visit). The study showed that the NICU Visit and Discussion & Observation guided by the clinical teacher impact on Total Perception of Learning. According to student evaluations, the Total Visits rating was the best single predictor of a positive perception of learning arising from NICU rounds.

Our findings suggest that interventions are likely to be more effective at improving student learning when observational learning, clinical guiding, discussions and feedback are factored in the design of education strategies. Students placed significant value on NICU exposure which linked knowledge to a real clinical environment. They appreciated the contextual authenticity in supporting a positive learning experience, supporting Hunter's (2008) recommendation that time should be allocated to give students the experience of NICU providing a safe practice environment that is built on a foundation of knowledge, learning and reflection (Hunter, Spence, McKenna, & Iedema, 2008).

It is accepted that students often experience difficulties in making the transition from theory to practice, which may reflect a failure of the training program to integrate these two components in ways that are relevant and meaningful to the students (Wrenn, J. & Wrenn, B., 2009). Students prefer experiential learning and need to be independent and self-directed. Adult learners may engage in learning because they like it and simply enjoy finding out about things (Merriam, 2001). The fact that students are exposed to clinical practice may strongly influence the way they develop their own learning (Pollard, 2008). The study showed that NICU-integrated learning drives students to adapt to an authentic hospital environment and social norms, thus improving insight into patient-centred care, effective communication, trust and teamwork.

If the teacher individualises and personalises learning as much as possible, letting the adult learner accomplish assignments that pertain to the real-life observation will provide a natural inclination to learn from NICU rounds (Holyoke & Larson, 2009).

Students appreciated the NICU face-to-face guidance and the briefing/debriefing sessions. The teaching focus emphasises the teachers' clinical knowledge, as a subject expert, and how it can be transmitted efficiently to the students. Students found that immediate feedback and the discussion sessions enhanced the quality of the learning experience, and motivated them to learn. More comprehensive indicators of student learning may go beyond fundamental learning objectives and include student perceptions of their increase in interest in the subject, critical thinking, interpersonal outcomes and self-esteem (Koon & Murray, 1995).

There are few opportunities in medical student training programs to integrate academic learning with practice in the NICU, which could motivate learners to strive for academic and clinical excellence. The study highlights the value of BST and observational learning as an adjunct to traditional case presentations and assessment. The study also demonstrates that the quality of the BST experience in the NICU is related to student preparation for the encounter, governance, soft skills competency, expert teacher-guidance and debrief sessions. However, it must be emphasised that the NICU is a place for skilled health professionals to care for severely ill newborn infants, and the best interests of the patient outweigh those of the educational endeavour.

We adopted the single facilitator endeavour, being cognizant of the fact that effectiveness and reliability of instruction and student learning outcome depend on standardisation and accountability of teaching. Internal standardisation among a group of clinical facilitators depends on collaboration and development of a common

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and agreed understanding and application of standards of teaching, instruction and feedback.

A. Limitations

The overall response rate to the survey was 52.5%, which may be explained by other commitments (e.g. preparing for exams). Investigating how students learn in the NICU environment may be influenced significantly by the clinical environment itself and by the formal curriculum. A student's first encounter with a neonatal posting may be overwhelming because they have much to learn as a new subject, and the duration of the posting may not be long enough. In the context of learning, students selected from semester 10 rather than semester 8 cohorts, may have adapted more quickly to the real-life situation in the NICU. In this study, the strategy focused on the students' ability to understand clinical practice in accordance with presented information led by teacher-guided experience. Thus, the teacher plays a key role in determining a student's learning and positive perception of learning during NICU rounds and in ensuring that learning outcomes are met. The cognitive focus of the present study rested on a student's perception of his/her learning instead of the assessment of learning outcome of knowledge gain. According to a study by Hulland et al. (2017), the purposes of rounds identified by medical students were a) communication, b) medical education, c) patient care and d) assessment. The absence of assessment of knowledge gain in informal learning such as NICU rounds may present a problem area in student education.

Supervised clinical observation which is not hands-on in the NICU setting in this study enhances medical students' learning perception of neonatology practice. Looking into the incorporation of the undergraduate neonatal curriculum in high-income countries such as Australia, Scandinavia, UK and US, the results of this study are not surprising. Weighing evidence of these results can be difficult because students have different understandings of the cultural, religious and social context that may lead to response bias. A response bias can be controlled by using interval questions, baseline data or data from a control group. However, baseline measurements were not available, because IMU students did not see critically ill newborn infants at the NICU prior to this study. Comparison with control group data was not an option because incorporating unequal educational strategies in the same cohort is a significant ethical concern and may offend the cognitive, intellectual and moral progress of student learning. Although this is a small study with the limitations mentioned, the pattern of findings raises intriguing issues for planning teaching strategies needed to guide the development of an undergraduate neonatal curriculum for medical students.

V. CONCLUSION

The study showed that NICU rounds as a format for observational learning by medical students and the clinical expert-guided discussions based on immediate observations can predict a student's learning perception. According to student evaluations, the rating of the NICU round was the best single predictor of a student's positive perception of learning. The survey demonstrated a fortification of students' understanding of perinatal and neonatal health issues through contextual authenticity in the NICU learning environment. The findings support the adoption of observation-based learning exercises to augment traditional case presentations in medical student training. Non-formal learning strategies can help create an innovative and supportive clinical learning environment for medical students that facilitates and promotes the achievement of learning outcomes. Moreover, in the context of an upper-middle-income country, participation or incentives that shift educational preferences and learning behaviours in neonatology is a promising strategy to improve learning perception of students.

Notes on Contributors

Stefan Kutzsche (S. K.) and Erwin Khoo Jiayuan (E. K. J.) were involved in the design of the work. S. K. was the single NICU facilitator during the study period and administered data collection through Survey Monkey.

S. K. and E. K. J. conducted data analysis and interpretation. Both drafted the article, revised it critically and approved the final version for possible publication in TAPS.

Ethical Approval

This study was exempted by Institutional Review Board (IRB).

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Declaration of Interest

The authors declare that they have no conflict of interest.

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